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Melting Steel Under Water
See Page 54

Popular Science

Founded MONTHLY 18

300 Pictures

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"The rubber in those tires came from Sumatra."

"That's a long way off, Son. How do you know?"

"Because they're United States Tires, just like those on my bike. The United States Rubber Company has a big plantation there—a hundred thousand acres—so they can grow their own rubber for tires, and be sure it's good."

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APRIL, 1919

Volume 94-No. 4

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H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer.

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From such men as these any man in business may learn.

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How "Silent Simms" Became a Master of Speech

By MARTIN M. BYRON

"YOU are exasperating beyond words," shot out Mr. Worden. "Why didn't you keep Mr. Truesdale here? You knew I would be back in ten minutes."

Harry Simms gulped hard, and replied weakly, "I did try to keep him here, Mr. Worden, but he wouldn't stay."

"What? Wouldn't stay even ten minutes? Why you could have kept him that long without his realizing it. Why didn't you *talk* to him about the weather, about peace, about the price of potatoes, about *anything?*"

This wasn't the first calling down I had heard Simms get. He had been with the firm for eight years and had reached the point where he was as much a fixture around the office as the desk or the chairs. He was a slow-going, steady plugger, earning $40 a week. He managed to keep busy in the Sales Department, keeping records of salesmen's reports. No one around the office seemed to notice him. He was so quiet that the only things that would start him talking were such momentous events as the beginning of the war or the end of the war. Even when his baby was born, Harry said three words—"It's a boy."

It wasn't long before we nicknamed him "Silent Simms."

Yet the "Silent Simms" of two years ago is now our Sales Manager, regarded as one of the most brilliant men in our organization, getting an annual salary that runs close to five figures, and is slated for the vice-presidency!

How all this happened in so short a time makes one of the most remarkable stories of success I have ever heard. But let Harry tell the story as he told it to me when I asked him pointblank what sort of magic he used in transforming himself.

"Well," said Harry, "You remember when Mr. Truesdale came in that day and I could not hold him for ten minutes until the Chief got back. And when the Chief came back and found Truesdale gone, how he bawled me out? *That incident marked the turning point of my life.* I made up my mind that I was going to live down the nickname of Silent Simms that had fastened itself upon me to a point where I hardly spoke to my wife. I was just afraid. I had almost forgotten how to use my tongue. Perhaps I got that way because every time I opened my mouth I 'put my foot in it.' I was always getting in wrong. I would give instructions and then have to spend twenty minutes trying to explain them. I would dictate a letter and then have to write five more to explain the first one. I would try to explain an idea to the Chief and would get so flustered that I couldn't make myself understood at all. In my social life I became almost a hermit. We never went out because I was like a sphinx among people. I was the best listener you ever saw and the *worst talker.*

"Well, when the Chief called me down that day it was the 'straw that broke the camel's back.' It was the most humiliating experience I ever went through. I had been with the firm 8 years—was getting $40 a week—and was the office 'football.' I went home that night determined to learn how to talk convincingly, interestingly, and forcibly, so that I could hold people spellbound, not only for 10 minutes, but by the hour. No more of the silent stuff for me. I had no more idea of how to do it than I have of how to jump across the ocean, but I knew that I wanted to do it, and I knew that I would never get anywhere until I did do it. It took a shock to make me realize what it was that was holding me down to the grind of detail work, but when I finally realized why I was called 'Silent Simms,' I began to investigate all that had been written on the subject of talking. I did not want to become a public speaker—what I wanted was the ability to talk as a business asset. I bought numberless books on public speaking, but they all taught oratory, and were so complicated that I gave up almost in discouragement. I continued my search, however, and was rewarded a few weeks later by hearing about the work of Dr. Frederick Houk Law of New York University, who was conducting a course in business talking and public speaking.

"You may be sure that I lost no time in attending the lectures. I went after them as eagerly as a hungry wolf goes after food. To my great surprise and pleasure I grasped the secret of being a convincing talker—the secret I had needed all my life—almost in the first lesson.

"Almost at once I learned why I was afraid to stand up and talk to others. I learned how to talk to a number of people at the same time. I learned how to make people listen to every word I said. I learned how to say things interestingly, forcibly, and convincingly. I learned how to listen while others talked. I learned how to say exactly what I meant. I learned when to be humorous with telling effect, and how to avoid being humorous at the wrong time.

"More important than these vital fundamentals were the actual examples of what things to say and when to say them to meet every condition. I found that there was a knack in making reports to my superiors. I found that there was a right and wrong way to make complaints, to answer complaints, to give estimates, to issue orders, to give opinions, to bring people around to my way of thinking without antagonizing them and about how to ask banks for a loan. Then, of course, there were also lessons on speaking before large audiences, advice on how to find material for talking and speaking, actual rules on how to talk to friends, to servants, and even to children.

"And the whole thing was so simple that in a single evening I learned the secrets that turned me into a very dynamo of ambition. I knew that I had at last found the road to Mastery of Speech. I began to apply the principles at once, and found that my words were electrifying people. I began to get things done. I began to put a new kind of ginger into my letters, into my memoranda, into my talks with customers, and with people in the office. In a little three minute talk with the Chief I nearly floored him with some ideas that had been in my mind for years, but which I had always been afraid to mention. It wasn't long before I was taken off my old desk and put at the city salesman's desk. You know how I made good. Seems almost like a dream now. Then, a short time later, I was given Roger's job on the road, in the hardest territory we have. And when I began to break records there the Chief wired me to come back and gave me Morgan's job as the sales manager when Morgan was put in charge of the Seattle office.

"This great change came over me simply as a result of my having learned *how to talk.* I imagine there are thousands of others who are in the same boat in which I found myself and who could become big money-makers if they only learned the secret of being a convincing talker."

When Harry Simms finished, I asked him if I could not have the benefit of Dr. Law's Course and he told me that only recently Dr. Law had prepared a complete course in printed form which contained exactly the same instructions as he had given in his lectures. I sent for it and found it to be exactly as he stated. After studying the eight simple lessons I began to realize that Simms's success was the natural outcome of real ability to talk. For my own success with the Course has been as great as his. I can never thank Simms enough for telling me about Dr. Law's Course in Business Talking and Public Speaking.

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P.S.M., April, '19

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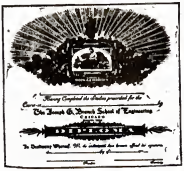

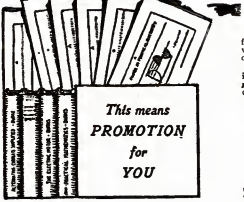

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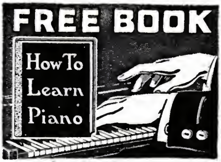

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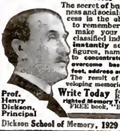

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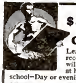

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The leading automobile factories in Detroit and other cities endorse our school, our equipment and our methods of teaching. Read some of their endorsements on this page. These were written in reply to letters from different parts of the country asking about us.

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If necessary we can secure work for you to help pay expenses while you are taking our courses.

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Letters from Factories

The Michigan State Auto School enjoys a very enviable reputation and is probably one of the best of its kind in the United States. I have no hesitation in recommending it in every particular.

Yours very truly,
PACKARD MOTOR CAR COMPANY.

The Michigan Auto School, in our opinion, is the finest institution of its kind in the country. So far as we are aware, its course of instruction is thorough, comprehensive and practical. In fact, we endorse its method of tuition.

We have recommended a great many students to them and the results were very satisfactory.

Yours very truly,
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The Michigan State Auto School: Wish to say that this is one of the best schools in the country, and would not hesitate to recommend it to anyone who is desirous of learning the automobile business. It is a recognized institution among the automobile factories of this city.

We have a great many graduates from this school in our employ and every one has given entire satisfaction.

Very truly yours,
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Your practice of co-operating with the factories is very commendable for it brings together the biggest men and most successful ideas to be had.

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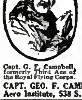

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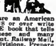

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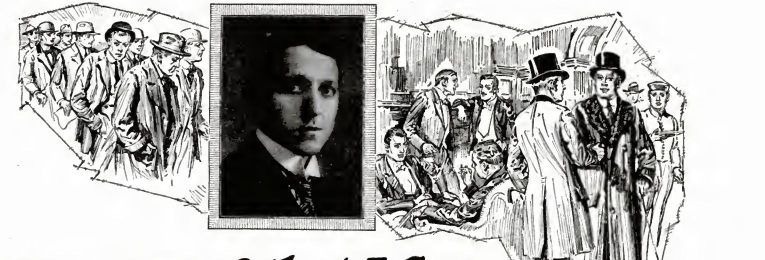

Free Proof that I Can Raise Your Pay

No matter how much you are earning now, I can show you how to increase it. I have even taken failures and shown them how to make $100—$200, and in one case as high as $2,000 weekly. I am willing to prove this entirely at my risk and expense.

LET'S have a little chat about getting ahead—you and I. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches.

I'm no genius—far from it. I'm just a plain, everyday, unassuming sort of man. I know what poverty is. I've looked black despair in the eye—had failure stalk me around and hoodoo everything I did. I've known the bitterest kind of want.

But today all is different. I have money and all of the things that money will buy. I am rich also in the things that money won't buy—health, happiness and friendship. Few people have more of the blessings of the world than I.

IT was a simple thing that jumped me up from poverty to riches. As I've said, I'm no genius. But I had the good fortune to know a genius. One day this man told me a "secret." It had to do with getting ahead and growing rich. He had used it himself with remarkable results. He said that every wealthy man knew this "secret,"—that is why he was rich.

I used the "secret." It surely had a good test. At that time I was flat broke. Worse than that, for I was several thousand dollars in the hole. I had about given up hope when I put the "secret" to work.

At first I couldn't believe my sudden change in fortune. Money actually flowed in on me. I was thrilled with a new sense of power. Things I couldn't do before became as easy for me to do as opening a door. My business boomed and continued to leap ahead at a rate that startled me. Prosperity became my partner. Since that day I've never known what it is to want for money, friendship, happiness, health or any of the good things of life.

That "secret" surely made me rich in every sense of the word.

MY sudden rise to riches naturally surprised others. One by one people came to me and asked me how I did it. I told them. And it worked for them as well as it did for me.

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. In one case I took a rank failure and in a few weeks had him earning as high as $2,000.00 a week. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered around" with it, barely eking out a living. Today this young man is worth $200,000. He is building a $25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who two years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work—in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black.

Then he learned the "secret.' In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were $20,000. During 1917 the profits ran close to $40,000. And this genial 64-year-young man is enjoying pleasures and comforts he little dreamed would ever be his.

I COULD tell you thousands of similar instances. But there's no need to do this as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you.

A Few Examples

Personal Experiences

Among over 550,000 users of "Power of Will" are such men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, Ex. U. S. Chinese Ambassador; Assistant Postmaster General Britt; Lieut. Gov. McKelvie of Nebraska; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis, former Vice-Pres. Art Metal Construction Co.; Gov. Ferris of Michigan, and many others of equal prominence.

$300 Profit from One Day's Reading

"The result from one day's study netted me $300 cash. I think it a great book and would not be without it for ten times the cost."—A. W. Wilkie, Faulkton So. Dakota.

Worth $15,000 and More

"The book has been worth more than $15,000 to me.—Oscar B. Sheppard, 1117 E. Locust St., Decatur, Ill.

Would Be Worth $100,000

"If I had only had it when I was 20 years old, I would be worth $100,000 today. It is worth a hundred times the price."—S. W. Taylor, The Sante Fe Ry., Milans, Tex.

Salary Jumped from $150 to $800

"Since I read Power of Will my salary has jumped from $150 to $800 a month."—J. F. Gibson, San Diego, Cal.

From $100 to $3,000 a Month

"One of our boys who read Power of Will before he came over here jumped from $100 a month to $3,000 the first month, and won a $250 prize for the best salesmanship in the state."—Private Leslie A. Still, A. E. F. France.

I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—everyone has. But I do claim that I can help 90 out of every 100 people if they will let me.

The point of it all, my friend, is that you are using only about one-tenth of that wonderful brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, although heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years, it would become powerless to lift a feather, from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Wills—because we continually bow to circumstance—we become unable to assert ourselves. What our wills need is practice.

Develop your will-power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—a power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And those are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

How You Can Prove This at My Expense

I KNOW you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny.

Send no money—no, not a cent. Merely clip the coupon and mail it to me. By return mail you'll receive not a pamphlet, but the whole "secret" told in this wonderful book, "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you do feel that "POWER OF WILL" will do for you what it has done for over a quarter of a million others—if you feel as they do that it's the next greatest book to the Bible—send me only three dollars and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a three-dollar sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

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How to Be Personality, Energy,

Unless your mind and body are capable of withstanding abuse without distress you have no real mental, vital, living or health power. You have but average power of life. You have but negative health. Real health power, real personal power, real power of life and real success come only through the vital power to live and the masterful power to succeed. The Conscious Evolution character of power of life, higher vitality and dynamic energy will enable you to easily master and enjoy conditions that now distress you. A unique and wonderful discovery that has revolutionized human possibilities and furnishes the body, personality and mind with a degree of driving and smashing energy that surpasses imagination.

Daily Results

"Problems that formerly worried me are now so easy as to seem almost unreal, since I gained power of personality through Conscious Evolution."

"I could see the tremendous reality and possibilities of Conscious Evolution in less than half a minute's direction of my energies into creative channels."

"Conscious Evolution has made me conscious of new enargy, of a better power of mind. I seem tireless. I seek action instead of stagnation, as formerly."

"I am filled with a new zeal."

"I would not take fifty thousand dollars for the power which in six weeks Conscious Evolution has given me."

"Ten seconds from the time I started Conscious Evolution I felt myself more aliva and energetic."

"I am happy to say that I received your instructions, and that in spite of travelling a good deal, my condition or power is remarkable at ninety years of age."

"I am eertain I am gaining in every way, for I feel as full of 'fight,' and energy, as a wild cat."

"I owe my rise from the position of a country insurance agent to virtual head of one of the largest insurance companies of the world entirely to the power of personality Conscious Evolution has given me."

"I became aware of the beneficial power of Conscious Evolution at the end of the first ten seconds."

"My weak will and personality for years made it possible for my business partners to roh me of my proper share of profits. Conecious Evolution gave ma courage, self-reliance and power of personality, and I made my partners pay me $160,000, out of which they had hulldozed me during my feehle and powerless days."

"In ten seconds Conscious Evolution proved itself to me."

There is a new and marvelous science of reconstructing and recreating the human organism and energizing the mind—a system of mental and physical evolution that has already revolutionized richly the lives of men and women all over the country. It has brought them a new kind of health, pleasure, strength, energy, confidence, might, power of personality and success. It has given them such marvelous energy of mind and body and they enjoy a life so full, so intense, so dominating, so thoroughly worth while that the old life to which they were accustomed seems totally inferior in every respect.

Dynamic Men and Women

This new system gives a new idea of how truly masterful, conquering, creative, healthy and happy a human being can be—how overflowing with life, dash, energy and the fire of triumph. It is thoroughly natural and simple but it accomplishes seemingly impossible results without study, loss of time, use of drugs, medicines, or dieting, without weight-pulling or apparatus, without violent forms of exercise, without massaging, electricity, cold baths or forced deep breathing, in fact this system does its revolutionizing work without asking you to do anything you do not like nor give up anything you do like. And so wonderful are its results that you feel the surging of the higher energy after the first thirty seconds—*half a minute.*

Gain a Conquering Personality

Many men and women have amazing memories, high education, excellent health and even unusual strength of body. Many are good-looking, are good talkers, and possess every advantage that training and blind evolution can give them. Many have read practically every book ever written on how to be a success and attain a dominant will power and yet these men and women are failures in life because they do not possess a vital, triumphant, dynamic power of personality. Their energies and knowledge are not creatively correlated and activated. They do not possess the conquering personal power such as *Conscious Evolution* develops and which is so essential to a really fine and true and beautiful success.

Conscious Evolution can quickly show you that you are only half as alive as you must be to realize the higher joys and complete benefits of living in full, that you are facing the world with only half the personality that you are easily capable of having, that you are not only half as well as you should be, half as vigorous as you can be, half as ambitious as you may be, and only half as well developed as you ought to be. In fact Conscious Evolution can demonstrate to you in thirty seconds—½ a minute—that you are living an inferior life.

A Giant In Mind and Health

A Supreme Life

The fact is that regardless of whether you are rich or poor, Conscious Evolution can prove to you readily, by demonstration, that you are leading an inferior life. You owe it to yourself to give Conscious Evolution the opportunity to show you the way in which you may completely and easily come into possession of a new dynamic life, and unusual vigor, a dominant type of high energy and power of personality—a new realization of the meaning of life and success.

Make Yourself Fearless, Forceful, Alive, Vital, Powerful, Dynamic, Constructive, Creative

Conscious Evolution gives greater power to live the superior life, the better life, the higher life, the more successful life, the life worth while and the life in complete accord with the ultimate laws of evolution and creation.

Do not be satisfied with the non-productive, inconsequential, empty, mediocre, non-creative life. Live the triumphant life, the productive life, the life of influence and importance.

Give Conscious Evolution a trial of thirty seconds—*a half minute*—and you will become personally conscious of the new life and higher energy and vitality of which you can have a superabundance, accordingly as you may really desire it.

Everywhere throughout the land men and women, in any walk of life, through Conscious Evolution are secretly and privately advancing themselves in life, happiness, joy and power—through consciously employing the principles of evolution. Whether you are a Doctor, Lawyer, Banker, Business Man, Financier, Mechanic, Soldier, Sailor, Laborer, Philosopher, or Scientist, Conscious Evolution is for you. It is for those who wish to make their existence on earth a source of higher, supreme satisfaction.

These Introductory Books Are Free

Swoboda has published for distribution two remarkable books which explain his system of Conscious Evolution and what it has already done. Write for these books—not because Conscious Evolution has meant so much to 262,000 other men and women, not because there is scarcely a prominent family in the country that hasn't at least one member a pupil of Swoboda, but because they contain valuable ideas for you. Conscious Evolution is being personally used by many of the most prominent physicians, and such men as Woodrow Wilson, Charles E. Hughes, the Rockefellers, the Vanderbilts, the Goulds, the Huntingtons, the Cudahys, the Swifts, and McAdoos for advancing themselves in energy, health, vitality, and power of personality.

Conscious Evolution is as Effective for Women as for Men

Write for these books because they mean so much to YOU in multiplied living power, earning power and personal power. They are filled from cover to cover with the vital facts about yourself and how you can acquire the degree of power in body and mind that you so consciously or unconsciously desire. They explain the dangers of excessive deep breathing, excessive exercise, and excessive muscular development.

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"Conscious Evolution can demonstrate its great power for every good in half a minute. It did this for me."

"Fourteen years ago at the age of 68 I was an old man; today at the age of 82 I am the marvel of my friends; I am younger than most men at 40. Your system gave me a new lease on life."

"Conscious Evolution sent a message of energy, health and power through me in twenty seconds, which has been increased from day to day."

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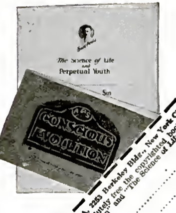

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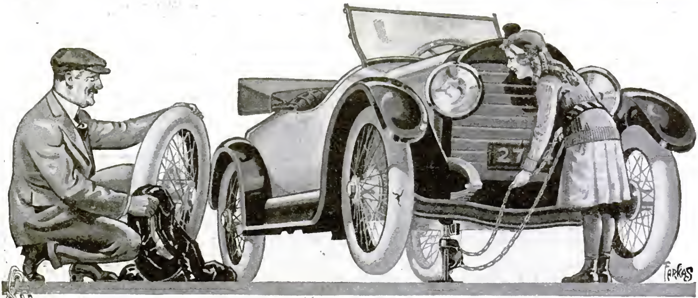

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Weed Chain-Jack

It's Child's Play to Operate It

Simply a few easy pulls on its chain lifts or lowers the heaviest car while you stand erect. Up or down—there's no labor.

To operate a Weed Chain-Jack it is not necessary to get down in a cramped, strained position and grovel in mud, grease or dust under a car to work a "handle" that is apt to fly up with unpleasant results. ***To lift a car*** with the Weed Chain-Jack, simply give a few easy pulls on its endless chain while you stand erect—clear from springs, tire carriers and other projections. ***To lower a car*** pull the chain in opposite direction.

Never gets out of order. Gears and chain wheel protected by a stamped-steel housing. ***Chain heavily plated*** to prevent rusting. ***Has a strong cap,*** providing the kind of support from which an axle will not slip, while a ***broad base*** prevents the jack from upsetting on uneven roads. ***Quickly adjusted to any required height*** by lifting the screw and spinning the corrugated "collar" shown in the illustration. ***Try it yourself***—you will never be satisfied with any other jack.

10 Days Trial

If your dealer does not have them, send $7.50 for any size for pleasure cars or $15.00 for the Truck size, and we will send you one, all charges prepaid. For delivery in Canada send $8.50 for any size for pleasure cars or $16.00 for the Truck size. Try it 10 days. If not satisfied, return to us and we will refund your money.

MADE IN FOUR SIZES

SIZE	Height When Lowered	Height When Raised	Height When Raised With Aux. Step Up	Price
8 inch	8 inches	12 1-2 inches	14 1-2 inches	$7.50
10 inch	10 inches	15 3-8 inches	17 3-8 inches	7.50
12 inch	12 inches	18 1-2 inches	No Aux. Step	7.50
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Popular Science Monthly

Waldemar Kaempffert, *Editor*

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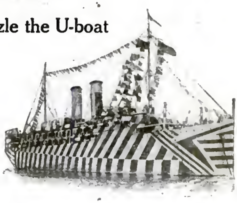
Fighting the U-Boat with Paint

How American and English artists taught sailors to dazzle the U-boat

By Waldemar Kaempffert



ROBIN HOOD was a camoufleur. Like all huntsmen from time immemorial, he wore green, so that he would blend in color with the foliage of the forest. He must have been all but invisible when he stood stock-still. Naval officers would say, in their technical parlance, that his visibility was low.

There never was a time, in the history of warfare, when similar camouflaging was not practised in a crude yet effective way for the purpose of concealment. Julius Caesar knew the value of low visibility; for he gave orders that the ships that bore him to Britain should be painted green and that his sailors should wear green.

The Romans camouflaged their ships when they went out to suppress troublesome Mediterranean pirates. And the seafaring Danes, too, long before the Christian era, tied boughs to their masts and lurked in forest-fringed bays to mislead their naval foes.

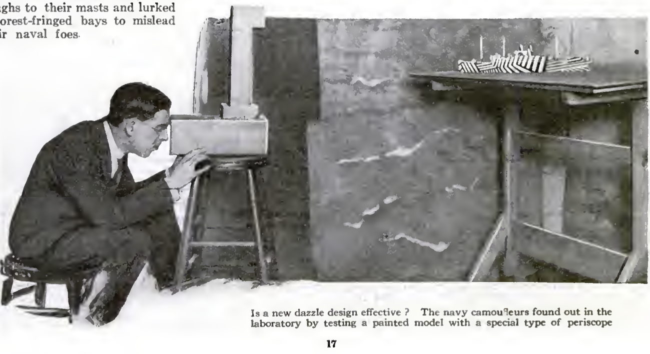
Battleships have been painted a dull slate-gray for a generation, to make them less conspicuous; but it is doubtful if their visibility was ever as low as that of the camouflaged ships of the ancient Romans and Danes. At all events, we know now that battleship paint was neither properly selected nor scientifically applied.

Artists to the Rescue

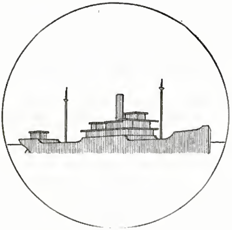
When the German U-boats began their depredations, it became desperately necessary to provide some protective coloration for transports, food-ships, and the hundreds of vessels that were carrying munitions to Europe.

Battleship gray having proved utterly useless, naval officers turned instinctively to artists for advice and assistance. If an artist, with his trained eye, knows how to apply color, knows how to trace lines on canvas so that they become the counterfeit presentment of the thing he sees, couldn't he reverse the process and devise some way of blotting out the thing to be looked at?

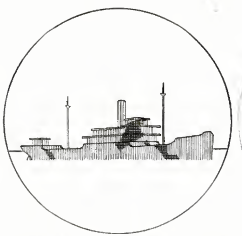
It so happened that American artists interested themselves in devising schemes of protective coloration as soon as the U-boat began to sink on sight. The pioneers among them were



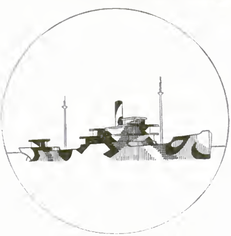
Is a new dazzle design effective? The navy camoufleurs found out in the laboratory by testing a painted model with a special type of periscope



Here you have the ordinary ocean steamship painted a battleship gray, which is supposed to conceal but doesn't. What is she but a collection of angles? She is visible at 15,000 yards



The forward part of the bridge and the deck-house are particularly conspicuous because the angles are accentuated by light and shade. The angles can be partially destroyed on a ship painted gray by applying masses of dark blue directly to the bridge angles and by diagonal stripes of dark blue on the hull



A further destruction of visible angles, as well as horizontal and vertical lines, is obtained by patches of black. Just where the patches must be applied is determined by study and experiment

William Andrew Mackay, Maximilian Toch, Gerome Brush, E. L. Warner, and Louis Herzog.

These artists relied almost entirely on their experience as observers of nature and colorists; no attempt was made at first to approach the subject scientifically.

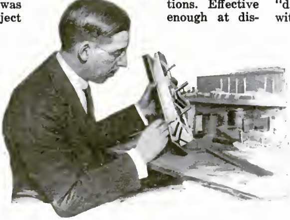
Standardizing Marine Camouflage

In 1917 the Submarine Defense Association was formed for the purpose of laying down the principles of marine camouflage and standardizing them as far as possible. The association was composed of nearly a hundred leading American and British shipping and export companies and all the leading marine insurance firms. Lindon W. Bates was made chairman of the Engineering Committee, and through him Mr. George Eastman became interested to such an extent that the resources of the Kodak Laboratory were placed at the committee's disposal so that camouflage could be studied scientifically.

The first inkling that ship-owners and the general public received that the apparently crazy splashes of paint and the freakish stripes that adorned the smokestacks, superstructure, and hulls of ships were not the whimsical color schemes of half-demented cubists and futurists, but very carefully thought out systems of protection, came in an order from the War Risk Insurance Board to the effect that ships not camouflaged according to the principles laid down by Mackay, Brush, Herzog, Toch, and Warner would have to pay a higher premium for marine insurance. The committee provisionally accepted the work of these five men as a basis, and then proceeded to study camouflage not from the artistic but solely from a dispassionate scientific point of view.

U-Boat Commanders Baffled

For a time low-visibility coloration baffled the U-boat commanders. It had its limitations. Effective enough at distances of 5,000 yards or more, it failed to protect at shorter ranges. Moreover, U-boat commanders were not dependent on their eyes alone; their craft were equipped with microphone sound-detectors—sensitive instruments that made audible the beating of distant propellers, the thumping of engines, the thousand and one murmurs, raspings, and clankings of a laboring ship. Even if the U-boat captain's eyes were momentarily fooled, his electrical ears were hearing.



They were not the mere whims of some demented artist, the curious patches of color that make camouflage look queer to us, but patterns designed after careful study by artists whose eyes have been trained to observe

Then it was that Mr. Mackay and Commander Norman Wilkinson, the distinguished English marine artist, independently began to experiment with the idea of throwing the U-boat commander off the track.

The man at the periscope has to sight and to take very careful bearings before he can plant a torpedo successfully. He launches his torpedo at a range of less than a mile, as a rule. Is it not possible to fool him as to the direction in which the ship is heading, or as to the part of the hull at which he is looking? That is the underlying principle of what is known as the "dazzle" system. It is now combined with the low-visibility system; for low visibility has advantages at ranges of more than 5,000 yards.

The "Dazzle" System

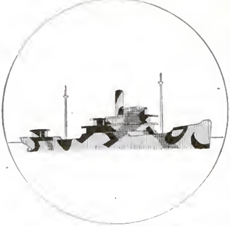
The dazzle system is really an evolution of the low-visibility system. It was discovered that, while large patches of color serve to break up the characteristic lines of a ship, smaller patches are even more effective.

Small patches, in turn, suggested stripes, and striping is the basis of some "dazzle" formulas. Low-visibility painting and dazzle painting are really antagonistic in principle. The one is most effective at long ranges, the other at short ranges.

Low visibility is of primary importance; dazzle painting is of use only at fairly close quarters after low visibility has failed. Low visibility is intended to prevent an attack from being made at all—the dazzle system to prevent the attack from being successful. Low visibility is always of primary importance, because it complicates the U-boat's task.

Suppose an uncamouflaged ship is visible at 15,000 yards. Skilful camouflaging will enable her to approach the seeing eye to within 5,000 yards without increasing her visibility. Interpret this fact in terms of the submarine. It means that more U-boats must patrol a given area traversed by camouflaged than by uncamouflaged ships.

The area of a circle varies as the squares of the radius. Hence, if a camouflaged ship can steam safely at



A final application of white in patches, scientifically disposed relatively to the gray, blue, and black masses, reduces the visibility to a minimum. A ship so camouflaged is harder to see at 5,000 yards than one uncamouflaged at 15,000 yards

And this is what the U-boat commander sees through the periscope—a confused jumble of apparently meaningless patches of black or color. It is difficult for him to determine in what direction the ship is heading

a distance of 5,000 yards and an uncamouflaged ship only at a distance of 15,000 yards, the area that a U-boat can effectively patrol is only one ninth as great if it is hunting for ships of low visibility. Nine submarines must patrol the area that could otherwise be covered by one. On the whole, more reliance is placed on the attainment of low visibility than on dazzling painting.

But, at least, dazzling the U-boat commander has this advantage. If he does not score a hit, he is sure to be run down or sunk by gun-fire when he comes up to find out whether or not he was successful. He betrays himself.

What Constitutes "Appearance"?

Look at that horse walking down the street. You recognize him at once as a horse, even though he is a quarter of a mile away. And why? Because of his general appearance, you say. But what constitutes "appearance"? Form and very little else—a peculiar arrangement of lines, curves, and angles. If you paint a picture of him you sketch on your canvas these lines, curves, and angles.

Out at sea is a ship. Like everything else in the world, she is to the eye a combination of lines and angles. In which direction is she heading? North-northwest, you say. How do you know? You judge the course chiefly by the motion of the superstructure, a thing that bears a certain angular relationship to the hull. Destroy these angles, or substitute others for them. The angles by which we judge relative motion are not those to which our eyes have been accustomed; the ship seems to be heading in a direction that is not her real course.

Look at such a ship through the periscope, and you will be dazzled—dazzled not in the sense that you find it painfully difficult to see, but in the sense that you are deceived. An error of a few degrees in course, of two knots in speed, or of two hundred to three hundred yards in range is enough to throw out the aim of the man who gives the signal to launch a torpedo.

It was the task of the Submarine Defense Association to determine whether low visibility was better than dazzle, or vice versa; whether low visibility should be combined with dazzle or not; and how the different low visibility systems compare with one another and likewise the different dazzle systems.

Scientific research proved that every dazzle system surrenders something to visibility. How much may thus be safely sacrificed in order to throw out the torpedo can be determined only after a long and patient scientific investigation. It seems certain, however, that dazzle painting on bows, funnels, and masts is very effective, the result being a confused pattern which usually deceives as to course, range, and speed.

Enter the Scientist

The first scientific study of marine camouflage has been made by Mr. Lloyd Jones, of the Eastman Kodak Laboratory. He invented a visibility meter in order to pursue his investigations. His dispassionate examination shows whether or not the particular shade of violet or green selected is scientifically the best, or how one dazzle pattern compares with another. The artist, having laid the foundation, gracefully retires and leaves the refining of marine camouflage to the physicist.

Literally thousands of low visibility and dazzle designs were experimented with in England and in the United States, until at last a few systems were evolved that made it difficult to see a ship at a distance as well as to determine her direction

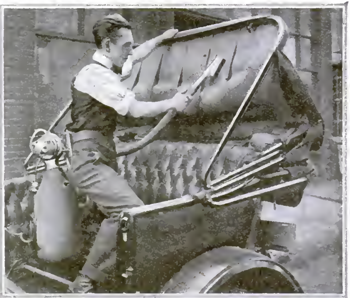
Jobs that a Truly Industrious

If your hot-air register refuses to work, it is probably clogged with dirt. Let your vacuum cleaner suck the dirt away. Hot air will then shoot forth

No wonder she "cleaned up." She drew their Red Cross money from them with a vacuum cleaner

© Underwood & Underwood

It is much easier to clean the inside of a box by inserting a tube than one's head, shoulders, arms, and a dust-rag

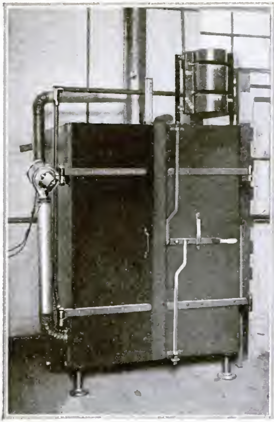


An ever-present cleaner hanging on your belt will lift the road dust from your automobile — if you own one

What chance do frost and ice stand of clinging to a window-pane when a vacuum cleaner gets after them?

All the little molecules of water that persist in clinging to photographic films are swept up by the cleaner

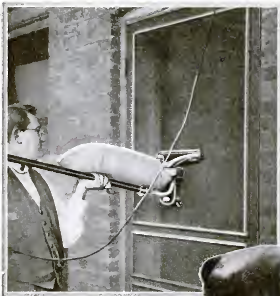
Vacuum Cleaner Will Do



Armatures, like pies, require an even oven. This oven for armatures was made even by a vacuum cleaner

Vacuum-clean the dust off your old boxes and sell your stock as new

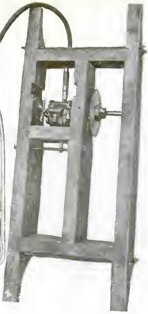
Cellars are damp and cellar floors usually wet. This one was, and she went after it with a vacuum cleaner



Screen doors gather huge quantities of dust from the street, and pass it along indoors every time the door bangs. If you pick the dust off the screen with a vacuum cleaner, you prevent dust and bacteria from spreading

As a reward for his faithful service Dobbin received the V. C

It's much better than hanging your head out of the window or airing it on the roof



The guard-rail of an old bridge had to be removed, and so the engineers cut off the planking by means of a compressed-air saw that they built themselves

Compressed-Air Saw Made from Old Drill

WHEN the highway engineers of the State of Connecticut had to replank one of the State's 1,800-foot bridges, they were confronted with the problem of removing the old worn planks without disturbing the guard-rail at one side. If the ordinary practice had been pursued, the guard-rail would have been removed, the new planking would have been fastened down, and then the guard-rail would have been restored. The method is slow, laborious, and expensive.

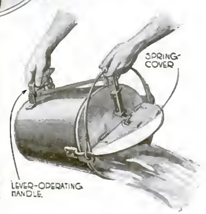
The State highway engineers decided to use an air-driven saw. What is more, they made their own saw. It has a heavy rectangular open-box framework similar to that used by concrete-makers for measuring sand or cement. The side members have their ends rounded off to form four handles, by means of which the entire tool may be easily moved.

The framework has a longitudinal center member which serves to support an ordinary portable drill transversely of the box. A shaft is inserted in the chuck of the drill, and a circular saw mounted on the shaft near the center member.

The apparatus was laid down on the planking and guided in a straight line along the length of the bridge by means of two narrow furring strips tacked to the planking at a distance apart slightly greater than the over-all width of the framework. The depth of the saw cut was regulated so that only the top worn layer of planking was removed. The frame could be rocked by the weight of the operator, and the depth of the cut regulated accordingly.

The use of the device made it possible to leave the guard-rail in place, and to fit the new planks to the edge cut by the saw without damaging the underneath layer of planks. The pneumatic drill was operated by compressed air supplied from a portable compressor installed for drilling and riveting work on the same bridge.

Grasping the handles opens the lid and the fire-bucket is ready for immediate use—provided it has been kept filled with water, according to the fire-prevention rules



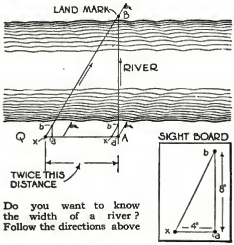
The spring cover will stay open as long as you keep a firm hold on the handle

To Determine Distances without Instruments

THE best way to determine the distance to an inaccessible point when you have no instruments is shown in the illustration. If you want to find the width of a river between the points *A* and *B*, place a pin in a board held over the point *A* to represent that point, another 8 in. from it for *B*, and still another 4 in. from the first pin in any direction as *Q*.

With the pins thus arranged in a triangle, and with one leg twice as long as the other and the longer directed toward *B* from *A*, set a line flag at about half the distance *A-B*, sighting across the short leg of the triangle.

Begin at *A*, and find the point *X* on *A-Q* where the long side of the pin triangle intersects *B* while the short side is pointed at *A*. The distance *A-Z* is then equal to one half *A-B*, and may be measured with a tape.



Do you want to know the width of a river? Follow the directions above

Lift the Bucket and the Cover Opens

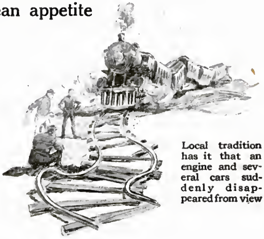
FREQUENTLY fire-buckets have no cover, hence the water evaporates. On the other hand, inspection in large cities often reveals long rows of buckets with a board running through the handles for a covering. You can see what that means when seconds are precious.

Here is a fire-bucket in which, in addition to the usual hand grip at the top, there is an operating handle near the bottom, connected by a system of levers to the lid, which is thus opened by the mere act of lifting the bucket. The lid closes when the bucket is again set down.

Mother Earth Tries to Swallow a Railroad

Thousands of car-loads of dirt have failed to satisfy this strange subterranean appetite

By Howard Egbert



Local tradition has it that an engine and several cars suddenly disappeared from view

THERE'S a hungry bit of land out in Darke County, Ohio, that is swallowing up a railroad track. Once in a while it bites off a freight engine or a string of cars trying to carry earth enough to stop its maw; but its regular diet is the railroad right of way, rails, ties and all.

More than three thousand car-loads of earth have been thrown into this "hole in the earth," as the engineers call it; but a child might have been at work with sand-pail and shovel, for all the good it did. The engineers won't admit yet that they are whipped, and the fight to save the railroad tracks goes on.

A Subterranean Lake?

A heavy rain always sends the cold chills running up and down their backs, because every rain makes the road-bed more unsteady. One of these days, it is feared, there won't be any road-bed, nor any tracks; and it is said that a whole railroad train might be swallowed up and engulfed.

Geologists who have been enlisted in the fight say that probably a subterranean lake or river exists not far below the surface of the earth at this point. Their belief is borne out by the fact that the swampy lands on both sides of the track eat up hundreds of carloads of earth, and that pools of water are making their appearance on the surface.

Local tradition has it that some years ago a dummy engine and several cars, endeavoring to stop this earth revolt, suddenly disappeared from view. The engine was never recovered, and is probably reposing a hundred feet below the surface at this point today. An effort was made to recover the cars, but they pulled away from their trucks and the trucks sank from sight.

Changes in Land Contour

Some pent-up force of tremendous pulling power has carried away every cubic foot of earth dumped into this stretch of five hundred feet, lowered the level of the railroad track, and, by some unusual underground operation, has made out of what was once level country a hill twenty-two feet high Whole rows of trees have been swept into new locations, and the old Fort Recovery road—along which General Arthur St. Clair, pioneer Indian-fighter of America, marched with his little band more than a century ago—is breaking up, crumbling, and disappearing entirely in some spots.

Indian Relics Come to Surface

Not long ago, in an effort to see how far a pole might be driven into the earth, George Kisiman, a railroad foreman, succeeded in driving a piling fifty feet into the earth, when the piling stuck. Pioneers in that section of Ohio, who have been studying the phenomenon for years, contend that the piling ran into the forest of trees and logs that were dumped into the lake years ago in an effort to secure a firm foundation.

From time to time the shifting and changing of the earth at this point has brought to the surface relics of Indian days—cannon, trappings, chains, and equipment that General Arthur St. Clair must have used, and probably lost in the treacherous marshes as he marched against the red men.

Although thousands of car-loads of earth have been dumped in, the railroad line is gradually sinking. The strange earth movement has moved trees ten feet from their original position

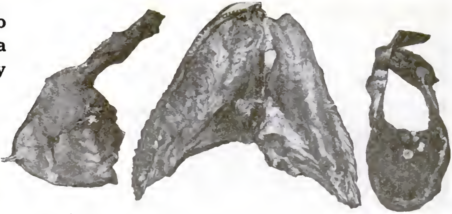
This road once ran level across the railroad tracks. Now great fissures are forming in it, and while parts buckle others disappear. The large drainage-pipes at the left in the picture below were forced to the surface by an earth movement that is swallowing the road and a railroad

The great fissures which are constantly forming in the road-bed make traveling on the road impossible. Railroad men and geologists have been working for years to solve this problem

Keeping Meat Fresh a Hundred Years

Condensing the ox to preserve him forever: a new marvel of chemistry

By John Walker Harrington



These three articles are cod, sea-bass, and salmon cutlet, all dried in a vacuum oven. They represent the result of the newest scientific method of preserving fish, meats, and vegetables

MEAT that can be shaken dried from a paper bag at the sound of the voice of the unexpected guest in the hall, and so served that the dear friend from the office will believe that its source was the family refrigerator, is the latest boon that science has evolved.

It means something to have on hand beef, sea-bass, and liver, as dry as the husks of the Prodigal Son, and yet capable of being converted by a little soaking into foods that have the flavor of cuts just from the butcher shop around the corner. Think what that means! You might be able to drop in for luncheon in your airplane at Mac Millan's headquarters at the North Pole next year, and eat what tastes like a perfectly new Delmonico steak.

The remarkable process by which the flavor is retained in flesh food was originated in the Harriman Laboratory, an institution founded by Mrs. E. H. Harriman in memory of her husband. As the late financier once told Dr. W. G. Lyle, the director of the Laboratory, he would have been a physician if his mind had not been turned to railroading.

The First Order

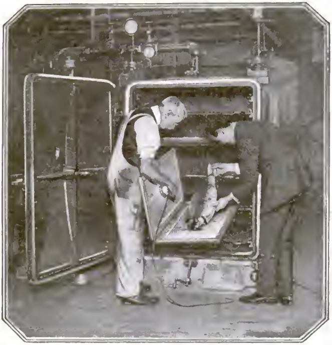
The laboratory devotes itself largely to discovering the errors commonly made in stoking the human furnace. When the United States entered the World War, the Government took over the establishment, which is situated on the grounds of Roosevelt Hospital, in New York city. The first instruction it received was from Lieutenant-Colonel J. R. Murlin, of the Division of Nutrition and Food of the Medical Department, United States Army. He wished to know what could be done to prevent meat from spoiling without injuring its nutritive value. It was a hard riddle to tackle, but Doctors Falk and Frankel, of the laboratory staff, reached the goal. They were assisted in applying the process on a large scale by Professor Ralph H. McKee, head of the Department of Chemical Engineering at Columbia University.

This Meat Will Keep Forever

The thing that causes meat to become unfit for use, unless it is cured or refrigerated, is the breaking down of its chief constituent, protein, which belongs to the same family as the white of egg. Any egg antiquarian would be able to give us an idea of just how bad such substances become. The jerked beef of the Western plains—dried for days and sometimes weeks in the sun—is so tasteless that the Indians and the Mexicans depend on red peppers to make their palates register food. The dried beef of the grocery store is treated with salt to keep it and with saltpeter to retain color. The new method does away with expensive and long-drawn-out preserving and smoking processes.

Its basic idea is the drying of the meat in a vacuum oven at so low a temperature that, after the water has been driven off, the protein and also the delicate ferments and aromas are not injured by the heat. The principle is the same as that of the vacuum kettle on which the candy-maker depends to keep his wares from scorching or growing tasteless in the making. For certain obvious reasons, the exact temperature used and other matters of the sort are for the present withheld; but the proof of the theory is in the eating. I have tasted all these products, and have seen them being dried.

First, the meat, cut either into inch cubes or in thin steaks, is laid on trays of wire netting. The trays are placed in an oven six feet square, which looks not unlike a bank safe, so heavy are its iron sides. Alongside is a pump that draws out the air and leaves the interior of the oven almost a vacuum. The moisture from the drying food is sucked into the big cylinder alongside of the oven, known as a condenser. The oven is kept warm by passing hot water through tubes with which it is lined.



A dried carp is just being taken out of an oven from which all the air was pumped out before the drying process took place

It's Condensed Cow Now

The length of the process depends upon the size of the pieces. About ten hours are needed for such meats as beef and mutton; and from four to eight hours for fish. The meat is first freed from bones, gristle, and

superfluous fat, which at once reduces a carcass to half its bulk. The cubes come out one third of their original size and approximately one sixth of their former weight.

A condensed cow, allowing for the discarding of the bones, would therefore be eight or nine per cent as bulky as when she browsed the meadow. She has gone by the same vacuum route over which her milk may have gone to the condensery

Transportation Charges Reduced

Should this process come into general use, it would greatly reduce transportation charges on all meats. It is estimated that, commercially applied, it would cost as much as refrigeration. Vessels that cross the sea with chilled or refrigerated beef give up fully as much space to the necessary apparatus as they do to the brightly hued quarters themselves.

What a great saving in cargo space would result, then, from desiccating steers of the Argentine down on the pampas, sending them across the Atlantic, and steeping them in water to expand them into the choice cuts of the beef of old England!

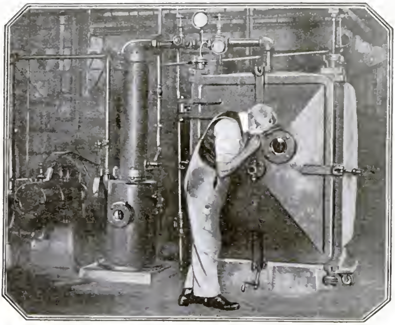
A large proportion of the cost of meat in the United States is due to its transportation, first on the hoof to the railway, and then on the ice to the East. Heavy charges are those which pile up on the way from the stock-yards of the packers to the steel-yards of the butchers.

Question of Cost to the Consumer

Just what the prices of meats and fish would ultimately be to the small consumer depends upon the interest that the wholesale dealers take in the matter. Many thousands of tons of the flesh of the creatures of land and sea are annually wasted which could be saved, were they not all eaten up in freight charges.

A Wafer of Liver

The Harriman laboratory is controlling the patent, with the idea of keeping it in trust for the public good.



The oven itself looks like a safe, so thick is the iron door. The moisture is sucked from the drying food into the big cylinder alongside of the oven

Food prepared in the new way is germproof. Even when exposed to moisture, only a slight coat of mold forms, and this is easily removed. Cheap containers of paper or pasteboard keep it very well, and large quantities can be packed in barrels, or even in burlap bags, without injury. For quick service meat in powder form is excellent.

Meat powder (*center*) that will some day be hash. On each side are pieces of meat before treatment and (*above*) after, when they are one sixth their original weight

The other day Dr. Frankel handed to an interested visitor a thin brown wafer decorated with a net work design.

"Very delicate," commented the favored one. "It's a new kind of chocolate, I should judge."

"Liver," was the reply.

Cut very thin and dried, liver can be preserved indefinitely. Fish having not a trace of salt, and retaining the fine, full flavor of sea food, are coming daily from the big airless oven at Columbia.

Also Dehydrated Vegetables

Vegetables also are being dried by this process, and the indications are that they will take a high place among dehydrated products. They retain the color and the taste of the garden, and experiments reveal that they also keep the invaluable vitamines — those little-understood forces that strengthen and nourish the body and keep away scurvy and wasting diseases.

A number of very fat rats, which are serving as test animals, are willing to testify to the worth of these supplies from the truck-patch.

Invitations to luncheon consisting of the vacuum dried foods are issued from time to time by the Harriman laboratory. The director has a French chef who has prepared some very delicious stews from the meats and vegetables sent from Columbia; but then, a French cook can concoct a dream out of an old soup-bone and a garlic suspicion.

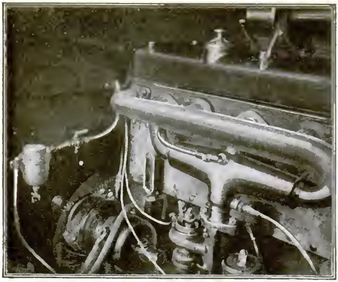
Even Dried Hash Stood the Test

Hash made by American boarding-house experts has stood the best tests, however; and down at Camp Oglethorpe in Georgia, last summer, three hundred soldiers were served dried beef stew and never knew that they were not getting fresh cuts, although they had it for weeks at a time.

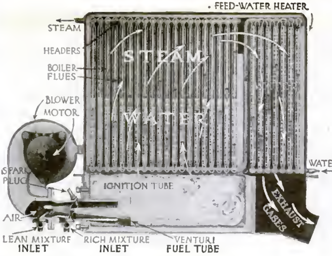
There will come a day, no doubt, when both the soldier on the march, and the housewife who can redeem herself as a bountiful hostess by just adding hot water and serving, will be singing the praises of the new processes.

Nature may abhor a vacuum, but human nature will sing no hymn of hate over delectable provender out of the heated void.

Vegetables also may be dried. Here are cabbage, carrots, potatoes, tomatoes, and cauliflower. They retain their color and taste and also the indispensable vitamines

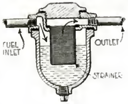


A strainer between the gasoline-tank and the carburetor will keep the needle valve clean



The lean fuel mixture of kerosene and air is brought to ignition by a mixture rich in kerosene, which is blown into the combustion-chamber and ignited

It Strains the Gasoline



SHOULD you go to your garage early some morning to get out your car, only to find that all of the gasoline had run out of the tank through the carburetor because a piece of dirt in the gasoline had clogged the needle valve, you would realize the benefits accruing from the simple gasoline-strainer shown on the car in the picture above. The strainer is fitted in the fuel line between the gasoline-tank and the carburetor, and is generally placed out of the way under the engine hood.

The device consists of a cylindrical, round-bottomed bowl with a removable cap. The fuel enters at one side of the cap, passes down and around a cylindrical screen of smaller diameter under the cap, up through the screen, and out to the carburetor on the other side of the cap.

As the fuel passes up through the screen, the water and dirt in the gasoline are prevented from going through and drop into the dome-shaped bottom, from which they can be removed by opening a screw plug.

Kerosene without Smoke

KEROSENE will not burn without smoke unless mixed with sufficient air. Yet a mixture containing finely divided kerosene and air enough for its complete combustion does not ignite readily. Abner Doble, well known as an automobile engineer, has solved this problem for steam-driven automobiles.

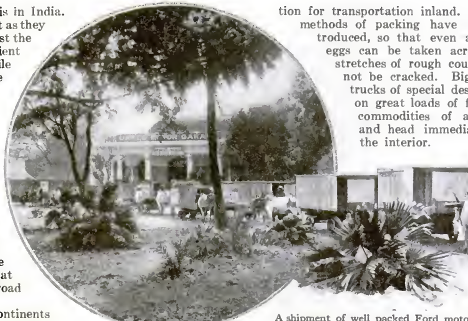
A centrifugal blower driven by a small electric motor forces air through two Venturi tubes. The suction causes the kerosene to rise in the supply-pipe, which opens into the air-tube, where it is atomized into a fine spray, and blown into the combustion-chamber under the boilers. By means of compressed air, independent of the blower, a mixture of kerosene spray and air, sufficiently rich in hydrocarbon to ignite readily, is blown into the combustion-chamber, to meet the stream forced through the Venturi tubes. The auxiliary mixture is ignited near its source by an electric spark and ignites the mixture rich in oxygen as it is blown into the combustion-chamber.

American Motor-Cars May Transform India

HONK! honk! The Ford is in India. They laugh at it there, just as they do everywhere, but it honks just the same. The driver passes an ancient shrine, and the Hindu priests smile and say something about the "tin Lizzies," but the machine continues the journey, ignoring the remarks.

In times of the great famines that occur in India, it has been almost impossible to help the hunger-stricken natives of the interior, owing to the slow haulage system. The vast population has cried to heaven for relief that seemed never to come. Is the Ford the answer? Can the natives be saved by the honking, bumping machine that always goes where there is a road left to travel?

Great ships from other continents now land immense cargoes of every description for transportation inland. Modern methods of packing have been introduced, so that even a box of eggs can be taken across long stretches of rough country and not be cracked. Big motor-trucks of special design take on great loads of food and commodities of all kinds and head immediately for the interior.



A shipment of well packed Ford motor-cars arriving at their destination at Madras, India

Now Comes the Electrically Heated Shoe for Automobilists

ADAPTED and commercialized from the electrically warmed suit of army aviators is a new electrically heated shoe for those automobilists who use their cars throughout the coldest part of the winter season.

As may be seen in the accompanying illustrations, the device is very simple. It consists of nothing more than a felt insole, provided with embedded resistance wires, which is slipped into the shoe.

The ends of the wires are attached to plugs sunk in the heels and led upward to the upper part of the shoe at the extreme rear, where two terminals are provided.

Any convenient arrangement of cords from the current source, which is generally a storage-battery, may be used for transferring the electricity to the two terminals.

The connection between the two is made by a small piece of metal with two holes, which are slipped over the two terminals.

The electric wires in the soles may be connected up to the storage-battery

Roadside Service Stations

ANYBODY who has ever changed a tire on the road on a hot day, with the sun beating down on his back, will appreciate the roadside service station, an institution recently inaugurated by an oil company of Southern California.

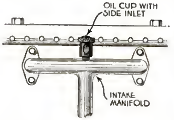
At various points along all public highways the company has erected tire stations like the one shown below. They are simple, inexpensive structures, but they offer shelter to the motorist with tire trouble, as well as the free services of the station attendant, air under pressure, and water if it is needed.

These stations are located near the oil company's fuel stations, and naturally the motorist who avails himself of the use of the shelter-houses will patronize the company stations. That's how the company "gets out" financially.

Priming a Motor through the Intake Manifold

PRIMING-CUPS on motors disappeared with the adoption of the self-starter, and are now rarely seen on new motors. But the poor quality of gasoline makes many an automobilist wish that his car was equipped with those same discarded priming-cups.

Instead of drilling and tapping four new holes in the cylinders, one car-owner drilled and tapped a ¼-in. pipe tap-hole in the intake manifold, and screwed in an oil-hole cover, as shown in the illustration. Thus the four cylinders can be primed through the one opening by spraying gasoline into it with an oil-can. This serves a double purpose; for, by opening it a trifle when the mixture is too rich, it serves as an air-valve.



A ¼-inch pipe tap-hole was drilled in the intake mainfold, and an oil-hole cover screwed in

A Bungalow on a Tractor

AN automobile tractor which uses motor-truck tires on the front, and a caterpillar tractor as motor power, was recently employed in hauling a bungalow several miles on ordinary oak runners.

The weight of the house was so great that within the first two miles two inches of the runners were worn down. But that did not prevent the movement of the house to its new position.

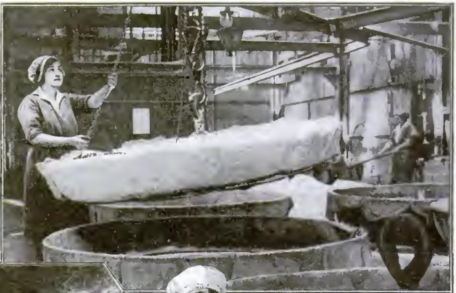
This type of automobile truck is used for heavy haulage, and not only can it carry a load of five tons on its own body, but the 100-horse-power tractor engine that furnishes the power enables it to pull from fifty to sixty tons more on four-wheeled trailers.

This is the first tractor we have heard of going into the house-moving business.

An oil company has built service stations for motorists near all their fuel stations

The newest use to which the tractor has been put is that of house-moving

Has She Got Your Job?



When the cake is done she takes it out of the vat, truly a housewife's job—only, this cake is made of muriate of ammonia

Hoisting barrels of oil into railway wagons has not injured this girl's vanity in the least

Not nearly so vain is this barefoot paddler. With her sleeves and trousers rolled up, she wanders lonely through long canals of starch in an English glucose factory and scoops it up with a wooden paddle

It is evidently the style in English glucose factories to roll the trousers up to the knees; for this young woman does it too, even though she is only screwing up the filter-press

Perhaps there was no lark so blithe as the miller who lived on the Dee, but he has many rivals among these jolly mill girls who are waiting their turn to dump their sacks

But no wonder these mill girls are happy — they punctuate their work by sliding down the sack chute after their sacks. We have seen other folk paying out good money to shoot the chutes

British official photographs; © Press Illustrating Service

Games Blind Men Play

Helping them to see with the ends of their fingers

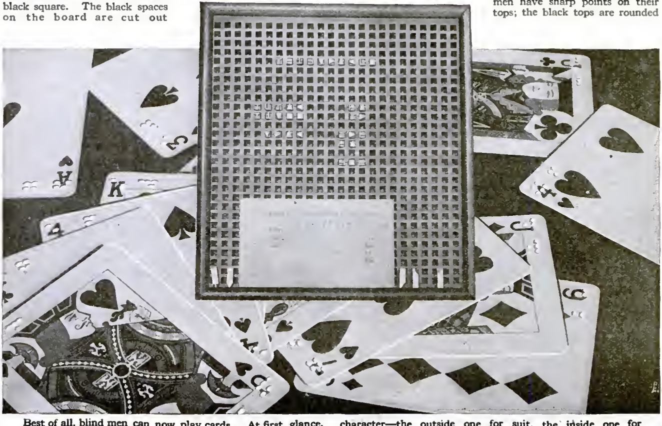
Photographs © Publishers' Photo Service

Raised numbers on dominoes notched so as to fit together have added the game to the list of amusements for the blind

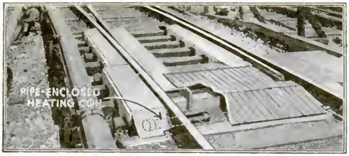
After dominoes, checkers are easy. White checkers are round and black square. The black spaces on the board are cut out

Chessmen have pegs that fit into holes in the board. The white men have sharp points on their tops; the black tops are rounded

By turning T's and L's and their respective triangular and square backs in different positions to represent different numbers, problems in mathematics are easily solved



Best of all, blind men can now play cards. At first glance, their deck looks just like ours, but letters from their alphabet are embossed in the corners of the cards to represent suit and character—the outside one for suit, the inside one for character. Three dots above and one below, on the inside, mean Jack. Three of these mean a good hand in poker



Suppose that railway switches were to freeze—what would happen to trains? Now you see why this switch-heater was invented

How Railroads Fight Blizzards with Electric Heaters

ONE of the most difficult winter problems of the railroads—and there are, of course, many problems of the kind—is to keep the switches free from snow.

A switch that is snowed in or frozen cannot be moved and is useless. Switches that are set by hand may be cleaned and swept by the switchman or brakeman and thus made operative, but the cleaning takes time and the movement of the trains is necessarily delayed. Switches operated from switch-stands can also be taken care of, but the work always causes delay, especially when there is a scarcity of men to do the work. The greatest difficulty is encountered in keeping operative switches that are set automatically or by interlocking devices.

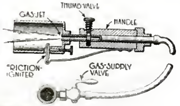
Where there are a great many switches, as for instance in big freight-yards or at railroad terminals, a blizzard necessitates the employment of a small army of men who employ various methods of clearing and thawing the switches. In some cases, gasoline or some other inflammable fluid is poured in and around the switches and ignited to melt the snow and thaw out the mechanism of the switches. Sometimes brooms and brushes are used after the bulk of the snow has been removed by shoveling.

Recently some of the big Eastern railroads have tried out an electric snow-melting device that has proved to be very effective. The heater units are inclosed in 3½-inch wrought-iron pipes 20 inches long, and a battery of them is placed between the ties, just under the rail.

They are connected by wires with an electric circuit sufficiently strong to heat the resistance coils to 100° C. in the first half hour, and to about 135° above the outside temperature within an hour. This heat is not high enough to set fire to the woodwork, yet sufficient to take the frost out of the ground and to melt the snow as it falls. To prevent loss of heat by radiation, the heating units are enclosed in wooden housings, placed against the rails.

A Gentle Tap and Your Gas-Lighter Is Ready for Use

TO strike a match and with its flame ignite the gas seems simple enough, but have you ever tried it? Sometimes everything goes smoothly: the matches are in the place provided for them, the particular match which you select behaves as a good match should—that is, it does not break, ignites at the first attempt, and does not lose its head. But, as a rule, something goes wrong. Even after the match has been safely ignited, there may be trouble. The gas pressure may be low and the flame of the match may go out before the gas catches fire, or perhaps the pressure is high, and when you try to light your oven, the rushing gas ignites with startling suddenness and burns your fingers.



No profanity-provoking trouble with matches, and no burned fingers, when you use one of these ingenious lighters

Every housekeeper and every cook has felt at times that they would give a king's ransom for a really reliable gas-lighter.

There are quite a number of gas-lighters on the market, all of them convenient and satisfactory—provided they are at hand when and where needed and do not balk. Here is a new type. It consists of a small-bore gas-pipe with a pressure-valve in the handle part.

One end of the pipe is connected by a flexible tube with the manifold of the gas-range. At the opposite end of the pipe is a gas-chamber, considerably larger in diameter than the pipe. Movable in a slot in the wall of the gas-chamber is a friction slide, which may be pushed into the gas-chamber against the pressure of a spring. When this slide is pushed in by pressing the outer end against some part of the range, the file-like surface of the slide rubs against a rod of some sparking alloy pressed against it by a spring, causing it to emit sparks, which ignite the gas released into the chamber by the simultaneous opening of the valve.

When Twelve o'Clock Means Midnight

IF you are told that a train will arrive at a certain station at 12 o'clock, you do not know whether the train is due to arrive at noon or at midnight. The adoption of the 24-hour clock would prevent any such misunderstanding. Some time before the war ended, the Swiss government planned to establish a 24-hour clock at the conclusion of the war. In southern Europe it is widely used.

If we used a 24-hour clock we should never confuse noon with midnight

In astronomy, too, the 24-hour day is used almost exclusively, not only in sidereal time, which depends upon the positions of the stars, but in Greenwich mean time, which is reckoned in the hours following Greenwich, mean noon. Longitudes are frequently reckoned in hours, but generally as east or west from Greenwich.

While at first it might seem exceedingly odd to us to adopt a 24-hour system, it would undoubtedly give much satisfaction, especially to users of railroad time-tables.

Cold? Burn Your Neighbor's House!

There were hundreds of cases of this form of vandalism in coal-less Chicago

By Fred Telford

A MICHIGAN man who owned a seven-room house in Chicago, failing to receive any remittance from his agent for several months, finally protested gently; whereat the agent, after making a visit to the premises, replied that there was no longer a house to rent!

Shortage of fuel, combined with severe winter weather, had combined to make irresistible the temptation to use the unoccupied building for fuel. Such volunteer wrecking is always going on in large cities, as every building department knows; but the damage from carrying away buildings piecemeal to use as fuel was increased fivefold by the hard conditions of the winter of 1918.

Same Old Human Nature

Human nature being the same the world over, the "technique" of volunteer wreckers varies very little. The first attack is almost invariably made on the inside, in some room in the rear. The reasons for this are obvious. If no complaint or warning follows, the wrecker proceeds with ever-increasing rapidity, usually knocking out partitions and stairways before much outside damage is done. Then the window-frames are taken, and the doors, the siding, and even the foundations. As many photographs show, the wrecking is done from the ground upward; often the upper stories are in fairly good condition when the first story has been almost completely stripped.

Though, as a rule, houses torn down for fuel are rather poor structures, this is not always the case. Buildings in first-class condition, if unoccupied and unguarded, may be destroyed. Even brick buildings are sometimes severely damaged by tearing out the doors, the window-frames, and the inside woodwork.

Why Authorities Are Not Advised

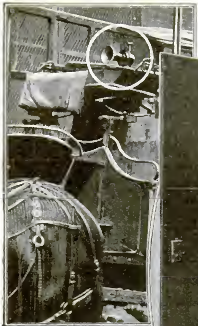
Any one of a number of conditions may account for lack of complaints to the authorities. The neighbors are not likely to say anything, because, in most cases, it is their own coal-bins that are empty. The policeman on the beat often does not discover what is happening until great damage has been done. When the owner is notified, he may take no interest, either because he is hundreds of miles away, because the building is a ramshackle one that will not pay for its own wrecking, or because it has been so damaged as to be worthless. The building department takes notice as soon as the wrecked building reaches a stage that makes it a fire-trap or dangerous to life and limb. In a surprising number of cases, the owner displays so little interest that the department, after vainly notifying him several times to have the building wrecked, orders the work done by a contractor and sends the bill to the owner.

The Huge Money Loss

The amount of damage done in such a city as Chicago or New York runs into hundreds of thousands of dollars. Last winter 287 buildings in Chicago were in such condition that the authorities ordered them torn down; many were so topheavy that they swayed in the wind, or fell against neighboring structures. Some were so dangerous that the fire department was called in to complete the destruction on the spot. Yet, in some miraculous manner, nobody was killed or even seriously hurt.

If you don't watch that house you own, some friendly neighbors may use it for firewood. This is what happened in hundreds of cases in 1918, when in Chicago alone 287 buildings were wrecked

And when these neighbors start picking, they usually work from the bottom up. The resulting wreck is top-heavy and therefore exceedingly dangerous



Keeping Up with the Times

A NEW YORK truckster, not being wealthy enough to buy an automobile truck when they came into vogue, was forced to remain true to his old-fashioned horse and wagon. Being old-fashioned has its difficulties, as this man found out. People were apt to disregard his "get out of the way," being accustomed to step lively only to the tune of an automobile horn.

One day he realized that one does not have to own an automobile in order to own the kind of horn used thereon. So he bought one and attached it to his truck. Now people jump to the sound of his toot, and he no longer fears running someone down.

An Open-Air Post-Office

ST. PETERSBURG, Florida, boasts the only out-of-doors post-office in the United States. It was erected as an experiment by the Treasury Department for a model to be used for post-office buildings in other semi-tropical cities, should this one prove satisfactory.

The building was constructed of white and buff marble, at a cost of $90,000. The design in the medallions over the arches is that of an eagle with outstretched wings.

This Door within a Door Solves the Valet Problem

HOW can shoes be shined and clothes pressed, at hotels, without disturbing visits from bell-boys? The answer is a small closet built into the door, so that it can be entered from the outside.

You simply place shoes and clothes in the miniature double-doored closet, or "servidor." The articles are extracted noiselessly from outside by an attendant.

The device is simply a door within a door. In carrying out the idea, the door is made thicker than usual, and hollow, so that it resembles a box.

Where the Gas-Meter Never Clicks

WHEN folks go boating at night on the pond at Decorah, Iowa, they light up the gas at the end of the landing, and no one cares if it burns all night; for there's no meter to keep tabs on the burning gas. You'd like to have a gas-light like that? So should we; but one must own a pond to get this kind of light.

It's not so mysterious as it sounds. Layers of decayed vegetation at the bottom of the pond give out marsh-gas, known as methane. All that is necessary is a barrel pushed, open end down, into the mud. The gas rises to the top of the barrel, a pipe with a valve controlling the flow.

Cease Admiring the Busy Ant

NOW that the war is over, here is something new to worry about. Chinese white ants have arrived at Los Angeles, city of moving pictures and concrete houses. The concrete interests them not at all, but the wooden reinforcements within do. They crawl into the very vitals of a house and start gnawing. In time the house totters and falls.

The lady in the picture doesn't seem to realize that the matter is serious.

Providing Mattresses for the Mississippi

THE Mississippi and the Missouri rivers overflow their banks quite regularly; and each time they do, the receding waters carry off some of the mud and sand from the shores. In order to save the river-banks from this constant erosion, brush mattresses are sunk along the shores.

Long willow twigs are closely woven and bound together with wire and cable. The finished mattresses are then released, and they slide into the river. They are towed to selected places and sunk by means of concrete and huge granite rocks, thrown on them from barges.

Match-Scratching Made Easy

NO longer need you kick up your heels in order to light a match; for William Cohen, of Oregon, has invented a match-scratcher which has on its back a pin by means of which you may attach the scratcher to other, more convenient parts of your body. Some prefer it inside their coats, others outside. The sailor in the picture hangs his from his trouser-top.

It is made like a cigarette-case, opens easily, and springs shut when released. A small piece of sandpaper is hidden within and on this you scratch your matches. When all the sand is scratched from the paper you may substitute a new piece. If you are careful not to catch fire accidentally, the scratcher should last a long time.

Did Judas Hang Himself on This Tree?

ON the Bethlehem road, half a mile from the city of Jerusalem, is a solitary tree of apparently no unusual antiquity, but long used by guides in the vicinity of the Holy City to tax the credulity of their patrons. Visitors are told that this is the tree on which Judas hanged himself.

In favor of identity, the tree has protuberances and holes that facilitate climbing, as well as horizontally projecting limbs favorable for "hemp" attachment.

Breastplates for the Mighty

ONE of the results of greatness is danger. Millionaires and others would do well to get one of these breastplates. When not in active service, it is collapsed and worn as an iron belt. All the layers are slotted at the ends and they are held together by bolts.

Those celebrities who go about in their shirt-sleeves will find the adjustment simple.

A Filipino Water-Carrier

THIS youthful water-carrier is a Filipino. His water-tanks are made of bamboo, and he hangs them on each side of his horse when he starts his day's work. His method of getting ready for an arduous day is unique. He simply fastens all the tanks in place with a rope, and makes a bridle for his horse out of the left-over ends. Then he sallies forth into a world of mud and insects.

The Philippines have a long way to travel before they catch up to their mother country.

The instructor came in the school on wheels, but the pupils supplied the cow

Taking a School to Its Pupils

A GLANCE at the photograph shown above might lead you to think that these prosperous-looking colored folk had never seen a cow being milked before. But you'd be wrong. Their intense interest is due to the fact that the traveling school of the Alabama Polytechnic Institute has just motored up, and the professor—he in the white coat—is showing the very latest wrinkles in milking. The pupils furnish the cow.

The school on wheels has the backing of the Department of Agriculture. It teaches not only dairying, but the care of orchards, scientific bread-making with barley flour, the substitution of peanuts and sweet potatoes for wheat, and the making of starch from green corn. The chemistry of soap is also explained.

Besides the useful household arts enumerated, the curriculum of this remarkable school includes, as well, the terracing of land, treatment of seeds, concrete-making, cotton-growing (including boll-weevil swatting), the management of live stock, and so on, not omitting furniture-making for the home, cooking, and the proper care and feeding of children.

This Plow Is Equipped to Dodge Trouble

THE plow that will not break when it strikes an impassable object is no longer a dream, but a reality. The "safety plow," an invention recently patented by Alexander Carpenter, of Carey, Ohio, can accomplish the feat unerringly.

A wooden pin that breaks when it hits an obstruction, allowing the plow to swing clear, is the main idea involved. The breaking stress of the pin is accurately determined, and of course is made less than that of the plow. A new pin is easily inserted immediately after each breakage.

The invention is intended to be applied to the power-driven type of plow; but the same idea can be carried out on an ordinary horse-plow.

When the plow strikes an obstruction, a wooden pin breaks and the plow swings up without suffering any damage

An Implement for Covering a Wheat-Field with Straw

THE time-honored covering of snow that keeps the wheat-field warm in winter now has a rival in the form of straw. Heretofore the expense of spreading the straw has been considerable, even if not prohibitive, but the manufacturers of farm machinery think that they have solved the problem by producing the spreader shown below.

Some of the problems that had to be overcome can be appreciated by even the unsophisticated city-dweller.

The wind has a tendency to carry the straw to a neighboring farm, unless special safeguards are taken. Especially is this true if the unloading is done broadcast from a high point in a high wind. What is known as a "beater wheel" is used to throw the straw downward to the ground, thus avoiding the wind effect. The distribution is quite even, and is under the control of the driver. In fact, the one-man feature of the machine is one of its recommendations, both in loading and unloading.

The driver simply places a ton of straw in the body of the machine and then takes a ride across the field. When he returns, the machine is ready for another load. The whole process can be made almost entirely automatic.

This straw-spreader places a warm covering over the sprouting wheat to protect it from the winter's blasts

To Prevent the Paint-Brush from Curling When Not in Use

YOU have probably noticed that when a paint-brush is allowed to stand for any length of time, the bristles assume a permanent curl which renders the brush unsatisfactory, and in many cases actually useless, long before the brush has been worn out. To prevent this curling, the weight of the brush must be removed from the bristles; and this can be accomplished by a suitable support like that illustrated below.

When the brush is not in use, it should be placed in a bath of oil or water, with the weight of the brush supported by the extension. Not only does this prevent curling, but the bristles clean themselves and caking at the base is prevented. If the support is sufficiently wide, moving it up and down will scrape the bristles and remove the paint.

The support is preferably of brass, aluminum, or some other non-corrosive material.

Quantities of paint-brushes may be saved each year by this attachment which supports the bristles when the paint-brush is not being used

New Floors for Old

NO matter how splintered and battered an old floor may be, it can be made the foundation for a cement floor. There are certain forms of cement that are very well suited to the purpose.

Some of these cements are light and easily spread, filling the cracks thoroughly and forming a good, sanitary flooring. The wearing qualities of such materials are excellent, and at the same time there is sufficient resiliency to make a good walking surface. This resiliency is a desirable quality from the point of view of the tenderfoot. Even the baby appreciates it, as can be determined by the tone of his conversation, and the baby is an expert critic on flooring and almost anything else we can think of.

These floors are spread with a trowel, and smoothed into a condition that appeals to the most fastidious taste. Moreover, they will stand any rough usage to which they may be subjected. Cement floors sustain heavy loads without cracking, and do not show marks or scratches from ordinary haulage — advantages that will appeal to every housekeeper.

Floors of this description have been used to advantage also in some of the large modern stables. It is easy to see that resiliency is important in a stable floor.

An old splintered and battered floor is made the foundation for a new floor spread on with a trowel

© Press Illustrating Press

Rapidly the button blanks fly out of the machine, the process resembling a machine-gun feed in action

Shooting a Hundred Buttons a Minute from a Machine

THE machine in the illustration is stamping out a hundred buttons a minute from brass sheets run beneath the dies. After passing through this machine, the button blanks go to a press for making the ornate designs demanded by the trade.

Rapid changes in shape and size necessitate the use of various kinds of dies and stamping tools. Even a very slight change in the shape of the button makes necessary a corresponding change in the die. The underlying principle is very similar to that of the big coining-machines in the United States mints, and anyone who has watched the coining of money will appreciate the intricacies of this button machinery.

Usually the button blanks are made in two parts, and are clinched together after the insignia or markings have been completed. Everything must be done very exactly in a machine-shop, if satisfactory results are to be obtained. It would be a difficult matter, if not an impossibility, to mark the buttons after the two parts had been paired and clinched, unless the carving is done by hand, and the hand-made commodity is costly and cannot compete with the machine variety.

How to change a hand process into a mechanical one is the thing that all manufacturers strive after. Curiously, this does not throw laborers out of work, for they are needed in increased numbers to run the machines and attend to the expanding business. The stamping-machine has expanded the button business far beyond the expectations of the manufacturers.

When the buttons are stamped and the two parts joined, they are colored by means of an air-brush.

After July 1—Tea?

Get acquainted with its habits and habitat

Photographs © Newman Traveltalk and Brown & Dawson

Tea grows on hillsides—preferably in Japan—and pickers gather the buds and leaves from the bushes

The tea-leaves are then carried to an up-to-date factory, where they are cured in the firing-room. They are heated to a very high temperature for about twenty minutes, after which they emerge firm and crisp

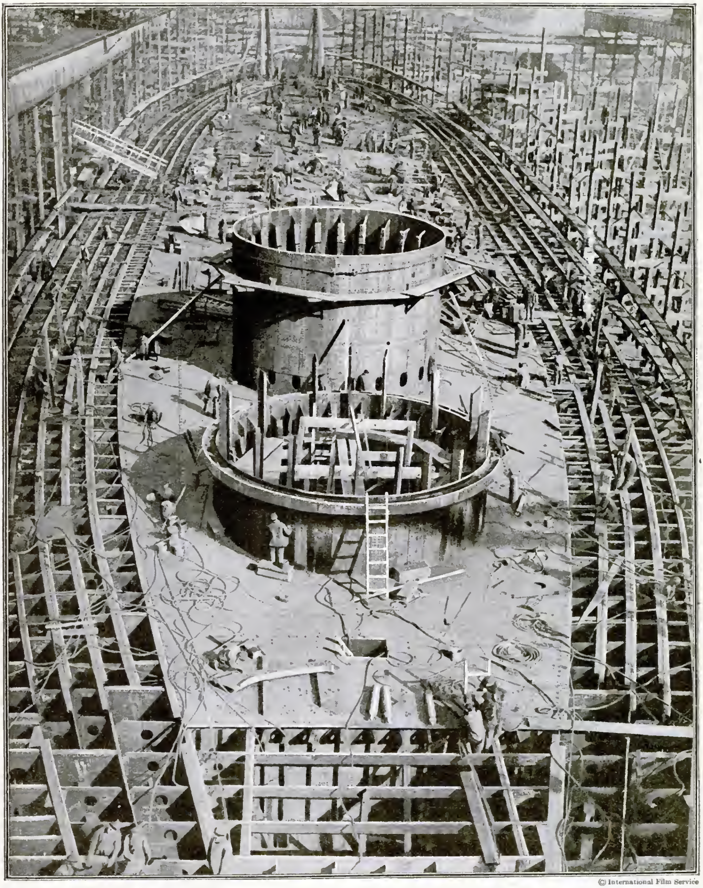
After the tea is cured it is cleaned and then sifted to separate the various grades. Then these grades are given names. Four grades of tea from one bush may have four entirely different names

All through the firing process the leaves are attached to the stems; but stems do not brew well, and so they are removed by the women workers before the tea is packed

Truly Oriental maids pack the tea in dainty paper bags sealed by labels that carry the name of each special brand in Japanese characters

All this work is done by the Japanese for an American firm, which, curiously, sells the tea to Japanese merchants for distribution in Japan

Our Latest Peace-Preserver



© International Film Service

The *Maryland* is to be our mightiest battleship. She embodies all the lessons taught by the war. Torpedoes were used in the Jutland fight. What about them? The *Maryland* has five hulls filled with oil to protect her against them. Heavy, long-range guns won the fight in the North Sea: so the *Maryland* has a main battery composed of sixteen-inch guns. Her boilers will be fired by oil, and she will be electrically driven—for oil-firing and the electrical drive are the latest development in propelling machinery. Her length is 624 feet, her tonnage 40,000

By running on railroad trucks, this plant turns out from 1,500 to 2,800 yards of mixed asphalt every day

Don't Waste That Old Sidewalk

WHAT can be done with an old cement walk? The old way was to tear it up and dump it somewhere—a total loss. What's the new way? Crush it and use it.

Now you see what the portable crusher in the picture is doing. The contractor is rebuilding the sidewalk with the crushed refuse that flows from the chute of the machine. A six-horsepower engine supplies the energy required. As the machine is fourteen feet long, there remains considerable space between the engine and crusher, which space is used for storing tools.

What's the good of an old cement sidewalk? This machine crushes it so it can be used again

An Asphalt Plant that Runs on a Flat-Car

THE illustration gives an idea of a Michigan asphalt plant that has been successfully turning out from 1,500 to 2,800 yards of mixed asphalt a day. The amount of production varies according to the distance of the plant from the scene of work.

There are three large tanks for mixing the asphalt, which is heated to a temperature of 300° F. The buckets at the front end of the machine are used to convey the sand to a drum, where it is heated to the same temperature as the asphalt. Another belt conveyor then takes the sand to the tanks. Power from a 70-horsepower engine is used for the purpose.

The plant runs on regular railroad trucks. The total length is sixty-five feet.

In transporting large tanks such as these, there is a very evident advantage in using the railroad construction type and in delivering by rail. The same idea would seem to be capable of great expansion. There are many unwieldy structures that might be so made and transported.

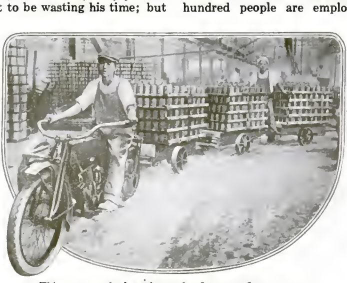
The Motorcycle Becomes a Mule

HE has gone to work at last, this motorcycle joy-rider. Formerly he was thought to be wasting his time; but an injustice was done him, for he was practising for his new job.

A Hawaiian pineapple company was the first to offer a job to this racing fiend. The company was short of help, and needed men to haul preserved pineapples from the cooling-room to the warehouse. Various schemes were tried or thought out to their logical conclusions; but the motorcycle fiend won out, and is now doing the work in a first-class manner.

A train of four trucks, having a combined weight of four and a half tons, is coupled to the motorcycle and hauled along the main floor of the cannery, where more than fourteen hundred people are employed. This method of local transportation has been used continuously during long periods, without accident, and at a cost of two and a half cents a ton. The distance traveled is about a fifth of a mile. There are three machines in use, hauling from ten to eighteen, thousandcases of pineapples a day.

The gearing of the motorcycle had to be modified somewhat, owing to the speed. A ratio of twenty-six to one was settled upon for low gear, sixteen to one for the intermediate, and ten and a half to one for high gear. The machines do the work of twenty-four men.

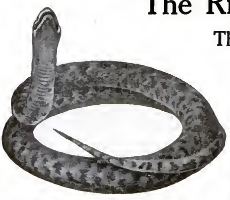


This motorcycle does the work of twenty-four men at less than one tenth the cost and at twice the speed

The Right Way to Stuff a Snake

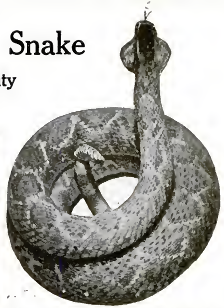
The result is often a thing of beauty

By Gustave Jermy



An example of perfect stuffing, with the snake placed in a natural pose

(*Above*) Cutting open a snake preparatory to the stuffing process: a razor-sharp knife should be used for this (*Below*) Sewing it up after stuffing tightly with cotton wrapped around wire



Another example of good work. This rattler in his lifetime measured more than seven feet

BE careful if it is a rattler, even after it is dead. A scratch from the fangs may prove fatal. The best material for stuffing is raw cotton wrapped about a wire. When this is inserted and sewed inside of the skin, it not only makes excellent stuffing material, but is useful in posing the snake, the wire affording the necessary flexibility.

To prepare a snake for stuffing, first cut it with a sharp knife from a point near the tail to a point about eight inches from the head. Then proceed with the skinning, taking out the tail portion first. Pull the skin over the head as far as possible, and cut through the body at the last joint, next to the skull.

Clean the head of all meat, including the eyes and the brain. A small spoon or chisel whittled from wood will be found useful in removing the brain.

When the skin is off, scrape it carefully and remove any fat that has a tendency to adhere to it. Now anoint the skin with a solution of saltpeter and alum.

Measure the snake's length, and cut a wire sufficiently long to go well into the skull, choosing the wire to accord somewhat with the size of the snake. The cotton covering for the wire should give it about the same proportions as the original body, and should be bound on with thin cord.

The brain should be carefully replaced with a quantity of cotton, some of which should be inserted in the eye-holes.

Saturate the skin with arsenic soap to poison it, and it is then ready to receive the cotton-covered wire. Insert the projecting end of the wire well up into the skull, pull the skin close about the neck, and begin sewing. Should the body not be thick enough, pack in more cotton as you proceed with the sewing. Having finished the sewing, put in glass eyes, being careful to give them their natural position.

Finally, pose the snake naturally, and the job is finished.

Think of a Lake that Is Always Frozen!

And that in torrid Africa

IT is a wonderful lake far off in the heart of Africa, where the sun blazes sublimely and causes the water to evaporate so quickly that an outlet is considered by nature to be a superfluity—a lake like our Great Salt Lake, where the inflowing waters have unloaded common salt for so long a period that the saturation-point has been passed.

But there is a difference in the material deposited. The soil through which the African streams flow is different from ours, and hence, instead of finding common salt or sodium chloride in the Magadi Lake, a chemical test shows us the presence of sodium carbonate (kitchen soda). Moreover, this sodium carbonate is crystallized into a solid mass—or in other words, is frozen.

Different substances solidify or freeze at different temperatures. Think of a lake sixteen miles long and four miles wide, frozen under the torrid glare of the African sun. Wonderful, isn't it—and yet, absolutely true.

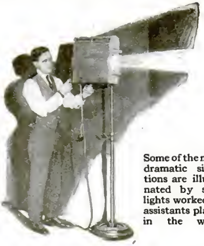
These people are walking on the surface of an African lake where the "ice" is composed of solidly crystallized carbonate of soda

It is a wild, uncivilized country in which this lake is located. Here and there may be seen the three-toed footprints of a stray rhinoceros that has labored through the alkaline soil. The country is being improved, however. The lake is in British East Africa, 252 miles west of Mombassa.

Mystery of "The Unknown Purple"

It is a matter of weird effects produced by a wizard of light behind the scenes

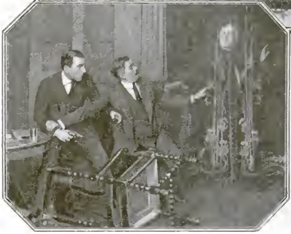
By John Walker Harrington



Some of the more dramatic situations are illuminated by side-lights worked by assistants placed in the wings

THOSE who have seen "The Unknown Purple" at the Lyric Theater, New York City, or who have read reviews of it, must be curious to know how its weird effects are produced.

This scientific - theatrical novelty by Roland West and Carlyle Moore, adapted from Mr. West's story, is based on the supposed discovery of a dye of such potency that the rays from it can make its possessor invisible. The strange properties of the X-ray, and the mystery as to the nature of electricity itself, which even the genius of Edison has not penetrated fully, give plausibility to the unusual plot.



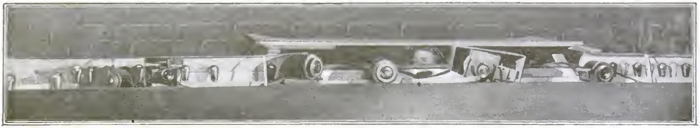
In the box at the edge of the stage sits the wizard of the switches. In our picture the side of the box is broken away so that you may see him at work at the climax of the play. By means of the lights under his control, he causes the visage of the man at the curtain to emerge from darkness and finally to float away in ghostly view. This effect is obtained by means of the small car at the right in the picture above, on which the actor steps and is conveyed slowly along a track while a skillfully modulated light provides the transfiguring glow

Peter Marchmont, the eccentric inventor of the pigment, is guilelessly carrying on experiments in his own house when, through the machinations of James Dawson, a double-dyed villain, he is sent to the penitentiary on a false charge, and his wife and his goods fall into the hands of the author of his ruin. While in prison, Marchmont perfects his invention, and on his discharge ten years later he starts to work out his revenge.

Prison life, as well as the baneful effects of the purple light itself, have so aged him and changed his appearance that he has a perfect disguise, even when not using his modern cloak of invisibility. Under the name of Cromport, a stranger and a philanthropist, he gains the confidence of his intended victims in the open, while by stealth he comes and goes with flashes and rappings and in tinges of purple haze, and robs them of all they have. Under the purple pall of his own making, he strips a pearl necklace from his former wife's neck, opens a safe and filches securities, and makes himself generally unpleasant.

After gaining the custody of his little son, the returned convict lingers about the house, rebuking and upbraiding Mr. and Mrs. Dawson. They get glimpses of his head, although there is no sign of the body in the chair in which he would appear to be sitting.

He finally makes a dramatic disap-

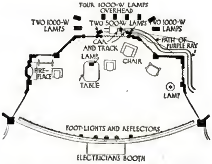


The den of the genius of light as seen from the stage. It is necessary that the changes of light be timed exactly with the lines, so the electrician has had to memorize nearly two hundred word cues. He watches the action through a narrow slit

pearance in a violet ray. The ingenious conception of the authors, and the convincing acting of Mr. Richard Bennett and his associates, are greatly aided by the mechanical devices that second their endeavors. Probably no American play was ever staged that depended more upon the skill of the electrician. We might therefore designate the wizard of the switches of "The Unknown Purple," Mr. Paul G. Zeidler, as its electrical conductor.

He is stationed in a booth in the orchestra-pit, watching the action from a long slit like that of a huge prompter's box. Before him, in closely compacted banks, are twenty-six switches and twenty-seven rheostats or dimmers, and these control the current that courses through six thousand feet of cable with which the stage is enmeshed. The changes of light follow nearly two hundred actual word cues.

To go into all the details behind the scenes would be to dull the zest of those who have not seen the play, yet the devices that are used in the finale are in themselves a story. The actor makes his farewell to earth on a miniature electric railway. The actor stands on a car eighteen inches in height which traverses a track that runs from the gauzelike curtain at the center of the back stage to the exit at the upper left. The play of lights about his head, in which he seems to dissolve from



The proper placing of the lights and the wiring of the unusual number employed is a big task in itself, as is suggested by this plan view of one "set"

view, comes from twelve powerful electric lamps under the control of the electrician and covered with purple gelatine. Above the star's head is a framework supporting four 1000-watt lamps. A pair of lamps of the same power rest on the floor at each side of him, while two 500-watt lamps are directly in front of him, and one is in the wings at each side of the arch.

The full power of the empurpled lights is upon the figure of the actor as he is confronted by the detective. The master of the circuits, working with great rapidity, causes the figure apparently to fade into nothingness as he gradually shuts off the currents with his dimmers.

No one who has not stood alongside of Zeidler can comprehend the marvel of this technique. As the chief actor seems to disappear and to speak from its center, the spot-light, the Purple Ray moves toward the left. The quick pressure on a switch by the electrician has started the Oblivion Express, and the whir of its motor, like the shriek of a banshee, can be plainly heard.

The time of the passage has been so painstakingly adjusted that the action cannot be intrusted to the mere walking of any man. Many have wondered, no doubt, why the voice of the player sounds so strong. He is being carried on his car just back of the walls of the room, which are composed of stretched gauze through which his speech is easily carried. He might just as well be on the stage itself, as far as the acoustics is concerned.

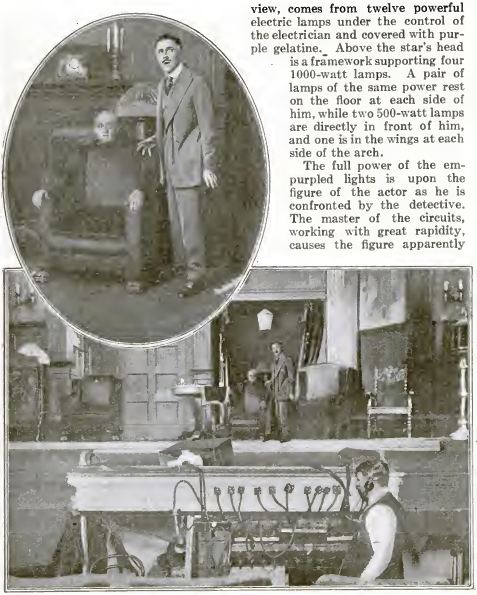
The Purple Ray spot is making its exit under the control of an assistant in the wings, with whom the chief electrician is in touch with the telephone attached to his head. In fact, if there is a hitch anywhere, the electric master of the show would know all about it through this instrument. At a certain point, a bar attached to the small car trips a lever, which overturns a chair on the stage at a tense dramatic moment, just as the wind catches the draperies and a phantom arm is seen. The Purple Ray has thus achieved the greatest happiness he has ever known, taunting his baffled pursuers the while as they stand amazed and ashamed with revolvers in their nerveless fingers.

Here every device of electrical and stage craft has been marshaled to give an effect which thrills even the most hardened of theater-goers. One who has been behind the scenes during the progress of the last act may well understand the statement that eight months of hard work was required before this strange combination of theatric illusion and staid science was considered letter-perfect.

The technique has now been so simplified, however, that the necessary properties can be transported everywhere and set up on any well equipped stage.

So great is the strain on the unseen operator in front of the stage at the big switchboard that it suddenly occurred to the management the other day, "What would happen if he did not appear some night?"

So it was decided to provide an under-study for him: for surely there would be something wrong with the performance if at the crisis the magician of the changing lights should himself get too great a dose of "The Unknown Purple."



The sudden appearance of the apparition in the arm-chair is obtained by using transparent material for the chair-back and by skillful manipulation of lights

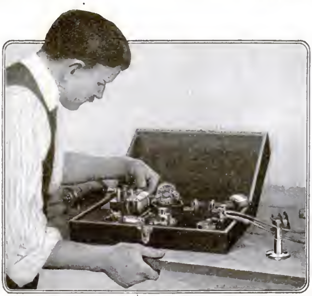
A New Apparatus for Discovering Magneto Troubles

ONE of the cleverest of the many aids now offered the modern automobile repairman is an apparatus designed to find out automatically the troubles of magnetos that do not operate properly. Heretofore this kind of work has been done by more or less home-made and imperfect apparatus. Few mechanics knew the best way to test for particular symptoms, and those that did took too much time because of the absence on the market of any apparatus made especially for the work.

The equipment shown in the two accompanying views was designed to overcome these troubles and make magneto repairing easy for the ordinary garage mechanic.

The device is fitted with the various attachments illustrated, and will tell immediately whether the condenser is out of condition, whether the collector is defective, or whether the armature is dead.

This instrument can be connected and disconnected at will upon any six-volt storage-battery circuit. It comes packed conveniently in a small mahogany case approximately fifteen inches long, eleven inches wide, and five inches deep.

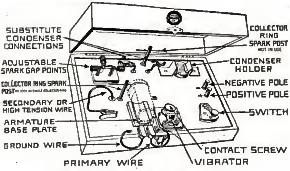


A valuable new aid for the automobile repairman automatically discovers magneto troubles. It is contained in an attractive mahogany case

Complete instructions accompany each outfit, and, if these are followed properly, the man who uses the outfit at once becomes an expert magneto repairman simply because the apparatus does most of his thinking for him and indicates wherein the trouble lies.

For example, the first thing to determine on a magneto is whether the contact points and the timing of the interrupter are in good condition. If these are in good shape, the entire armature should be removed and placed upon the armature plate.

Following directions, certain connections are then made, after which it takes only a few seconds to determine whether there is a short circuit in the condenser or in the primary lead of the armature.



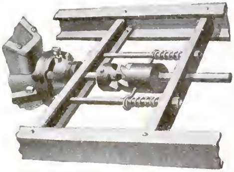
This trouble-finder can be connected with any six-volt storage-battery

It Makes Hill-Climbing Safe

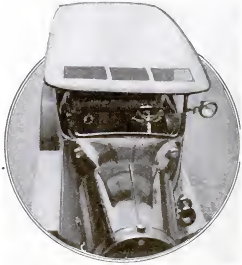
ANYONE who has narrowly escaped a serious accident, and perhaps death, by having his automobile engine stop or go dead on a steep grade, and start to slide backward before the brakes could be applied, will appreciate the invention of Thomas Milldown shown below.

The device is designed automatically to lock the rear wheels of an automobile as soon as the engine stops, no matter whether the brakes are in proper condition or not. It consists of a two-jawed clutch fitted into the main driving shaft of an automobile aft of the gear-set. The front jaw is keyed to the shaft, revolving with it. The rear jaw is loose on the rear end of the driving shaft, but is held from revolving about the shaft axis by means of two eye-bolts screwed into the jaw and then slipped over two longitudinal rods permanently fixed to two transverse pieces supported on the chassis frame.

With the engine revolving, the front jaw throws the rear one out of mesh automatically by the shape of the teeth. But when the engine stops, two springs around the longitudinal rods force the rear jaws into the mesh with the front one and keep it there. Since the rods cannot revolve, because they are mounted on the fixed cross-members, the entire driving shaft is held stationary, thus preventing the rear wheels from turning. If the car then moves backward, it will be only after wearing out one section of the tire through friction.



It locks the rear wheels of an automobile when the engine stops



An automobile-top that has three transparent celluloid windows

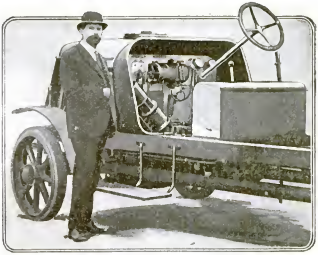
Is This for Star-Gazers?

BY cutting openings in the top of the car he uses for wire and pole inspection, a railway superintendent has made this work much easier. As the illustration shows, three windows of transparent celluloid, about 10 by 12 inches each, are set in the top exactly over the driver's seat.

This British Steam Motor-Truck Has a Coke-Fired Boiler

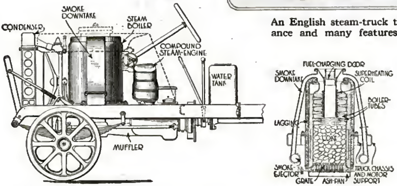
If you could run your car on some new fuel costing only one fourth as much as gasoline, you would use that new fuel in nine cases out of ten, provided it did not upset many years of experience in driving a gasoline-engine car. This is the principle upon which Thomas Clarkson, a noted steam engineer of Great Britain, has worked to produce a new steam-lorry or motor-truck which tests have shown to be one fourth as expensive as the same type of vehicle driven by gasoline.

Radical changes have been made in the design of the new truck; for, unlike the big, lumbering steam-wagons with high locomotive-like exhaust stacks, it has a clutch-pedal for the left foot, a brake-pedal for the right foot, a center gear-shifting rod, and at the extreme right a long emergency brake-lever. The steam generation is controlled automatically.



An English steam-truck that has the appearance and many features of a gasoline-truck

Furthermore, this new truck has an engine clutch and gear-set to give more than one transmission speed, the better to meet average road conditions, besides tending to simplify the engine by eliminating the expensive reverse gear. By the use of the clutch, the engine may be run "free," a very useful advantage when warming up or in making repairs. In an actual test, the engine and boiler were left with steam up all night, the engine regulating the water-feed, lubrication, and boiler pressure.



The coke is fed down into the combustion space inside of the inner shell, dropping through a hole in the top on the rocking-grate arrangement at the very bottom. Every fifteen or twenty miles the fire is replenished

The Clarkson power plant consists of three main parts—the boiler, the engine, and the condenser. The boiler is built on entirely new lines, burning coke as a fuel. It is set upright under a hood forward of the driver's seat, as in gasoline-engine trucks. The boiler is made up of two cylindrical steel shells, one inside of the other. Each shell has flanges by which the two are bolted together.

The water is carried between the two shells, and heated by small hollow thimbles which are pressed into the inner shell in a series of horizontal rings. The coke is fed to the combustion space in the inner shell through a hole in the top and drops to a rocking-grate arrangement at the bottom.

It has been estimated that a truck with a coke-fired boiler can be run at one fourth the cost required for a gasoline-engine truck.

Something New in Rear-End Control

Of simple construction, it's a great comfort when you get stuck in the mud

Suppose you were out riding in the country in your Ford car, and suppose your car got stuck in a mud-hole. No one in sight, and not even a plank or a tree to help you extricate the car. Now suppose you had only to go to the rear, pull a lever, pushing the while with your shoulder against the back of the tonneau, and just follow your car back to firm ground?

An invention by a Minnesota man makes this a reality by a simple spring-rod attachment running from the rear axle to the speed levers and carburetor, the connection being such that when the brake-lever is swung to immediate speed or vertical position the clutch-pedal will be swung to neutral position, the brakes not being applied unless the brake-lever is swung to its backward position. It also connects with the shank of the brake-pedal, and with the carburetor, having a helical spring which has one end bent to form an eye that encircles the shaft, with its opposite end hooked into a near-by plate, the spring serving to hold the parts in position.

In extricating his Ford from mud-holes, this invention enables the driver to operate his car from the rear

If the Ford is embedded so deeply in the mud that the engine is not capable of pulling the car out, the driver swings the hand brake-lever to neutral, releasing the speeds, so that the engine is idle.

By the insertion of a handle (in most cases a jack-handle) into the socket, pulling it upward, and at the same time pushing against the back of the car, the handle moving upward speeds up the engine and slowly pushes the pedal into low speed. Thus power is transmitted to the rear wheels, and the driver soon has the car upon firm ground.

Some Freaks of the Tree World

Some were born queer, and others had queerness thrust upon them

© Underwood & Underwood

This hole in a tree is a mosque dug out by Mohammedans in Calcutta, that they might worship therein

A wind-storm swept across a forest down in Louisiana. This long-leaf yellow pine bent to the ground, but would not break, although some of the fibers have parted. When the storm had passed, it did not straighten, but remained bent, making an almost perfect arch

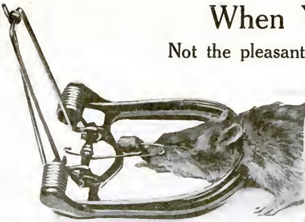
A squirrel hid an acorn in the stump of an old cedar tree, and then forgot all about it. But from little acorns great oaks grow. Result a tree within a tree

This is not a horny animal, but a fallen tree-trunk. The seeming horns are but twisted branches, and obliging knots make the eyes, ears, and mouth. Natives of the San Bernardino mountains, where lies this old tree-trunk, call it "the deer's head"

An Indian bent this tree to earth when it was very young and full of the desire to grow. So it branched from the middle of the bend. The tree-top has emerged, but branches continue to flourish from the bend

When You Go a-Ratting

Not the pleasantest indoor sport, but often necessary



"Caught like a rat in a trap."
So this is what it means!

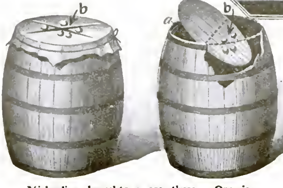
Below: There are twenty-three rats, a few mice, and the traps that caught them in this heterogeneous pile. Rats prefer to live and die in clean places, and, as these traps were exceptionally clean, the rats walked into them

Right: These embryo hunters are getting their first taste of blood. Armed with shovels and sticks, they surrounded the hen-house and killed all the rats therein

He who walks this plank does so at his own risk; for on the water floats a tempting bit of bait, and just below that lurks a trap

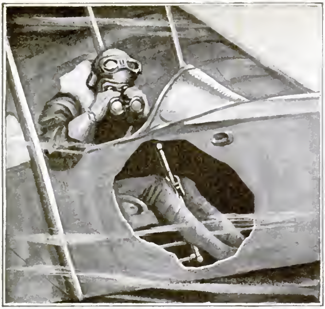
Carbon bisulphide is poured into rat burrows and the burrows sealed up. A gassing like this will get them all, young and old

This is a cat and some of the rats she overlooked when cleaning out a ship. She, in turn, was overlooked by the fumigating expert



Misleading barrel-tops are these. One is slit paper and the other top tips. Result? Rats fall into the water below and are drowned

A close-up of four barn victims. It's a harrowing picture, but rats and mice destroy millions of dollars' worth of grain each year

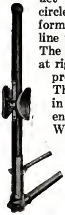


Work the joy-stick with your knees while you eat your luncheon or view the fields below on a cross-country flight

You Can Operate the Joy-Stick with Your Knees

PILOT Robert F. Shanle, air mail-carrier between New York and Washington, carries his luncheon with him on his daily flights, and eats it while speeding through the air. How can he eat, with both of his hands constantly employed in controlling his machine?

It is true that the steering and controlling mechanism demands constant attention, but the recently invented knee control enables the aviator to guide his machine, as an expert rider guides his horse, with his knees, leaving his hands free to operate a camera, draw maps or sketches, or anything else he may like.



The invention is extremely simple. An adjustable ring, to which at opposite sides two curved pads, shaped to conform to the knees, are attached, is slipped over the control lever, or joy-stick, and fastened by a clamp screw. The device is so placed that the aviator, sitting on his upholstered seat, can place his knees against the two pads. By rocking his knees from side to side, or by sliding a little forward or backward on his seat, the pilot can operate the joy-stick without using his hands.

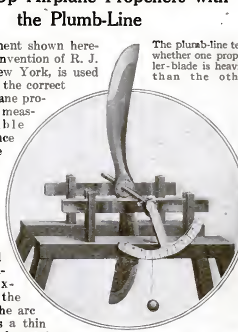
"Popular Science Monthly" in the Foreign Service

SOMEBODY in Pawtucket, R. I., has been making a company of men attached to the 18th Labour Group Headquarters of the British forces in France very happy by sending them copies of POPULAR SCIENCE MONTHLY. He (or she) responded to the appeal of one J. Baker, of His Majesty's forces, printed in our November number.

Mr. Baker, a Tommy for the duration of the war, wrote that POPULAR SCIENCE MONTHLY was in great demand at the front, and that he and his mates would let out a yell that would scare the Germans if someone sent copies their way.

Now Mr. Baker wishes us to thank the unknown donor of the magazine, and we are delighted to be the conveyor of his message.

Truing Up Airplane Propellers with the Plumb-Line



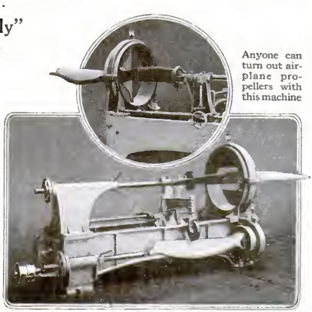
The plumb-line tells whether one propeller-blade is heavier than the other

THE instrument shown herewith, the invention of R. J. Hoffman, of New York, is used for determining the correct balance of airplane propellers and for measuring possible weight difference between the blades. It is made of three-ply wood, in the shape of an anchor. The curved part has upon its flat surface a graduated scale. Suspended from the exact center of the circle of which the arc forms a part, is a thin line with a plumb attached. The shaft through the center hole of the propeller is placed at right angles on two parallel and level knife edges. The propeller is allowed to swing until it stops of itself. Then it is given a quarter turn, and while it is held in position the measuring instrument is fastened to the end of the shaft so that the line intersects the arc at zero. When released, the propeller, if it is perfectly balanced, will not swing and the plumb-line will remain at the zero mark. If it is out of balance, the position of the line will indicate the deviation in inch-ounces.

Skill Is No Longer Necessary in Propeller-Making

EVERY airplane must have at least one propeller. During the war the demand for propellers became enormous. You may think it an easy matter to make an unlimited number of airplane propellers. It is not. The making of such devices is a difficult and delicate task which has heretofore required exceptionally skilful and experienced workmen.

Airplane propellers are made of wood, but they are not carved out of solid blocks. Layers of wood of even thickness are glued together, and the composite blocks are then carved, shaved, scraped, and sandpapered into shape. At first the work was done by means of hand tools; but this method was too slow, and some better means had to be found.



Anyone can turn out airplane propellers with this machine

A machine for shaping propellers has now been invented and introduced in England. The machine copies a given model which is fixed to a driving head at the side of the frame, and which rotates at the same rate as the block from which the new propeller is to be cut. Over the surface of the model a copy wheel is made to pass, and by suitable connecting levers the cutting wheel is given the same feeding rate. The block of wood is fashioned into an exact copy.

Wouldn't You Like to Live There?

Built-to-order villages that combine the best in city and country life

A WELL known architect, Henry Atterbury Smith, has taken all the good points of city and country life and from them has designed —and, what is more, built—an ideal village.

The inhabitants live in the very best of apartment-houses, all of the windows of which open out on charming landscapes instead of on other folks' back yards. Many conveniences are thrown in with your four rooms and bath when you pay your exceptionally cheap rent. Farms, lakes, rocks, parks, and lawns tempt the most fastidious country-lovers. Then, for those who wish to be amused, a casino, ball-field, and tennis-courts; a library for the studious, garages for automobile-owners, and a playground for the children.

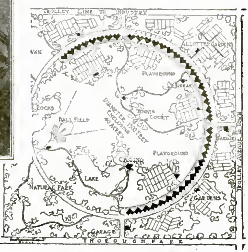
Mr. Smith builds these villages of his within the suburbs of large cities where transportation facilities are good. He picks out a sixty-acre square of fertile ground. He builds a circular road just within his square, and erects a semicircle of apartment-houses which will accommodate two hundred and fifty families, twelve to a house. All walls are at right angles to their adjacent walls, and this makes possible light in every window. Then, too, each house has a non-intercommunicating staircase.

A rent-collector, a plumber to mend leaks, an exterminator to chase away bugs, visit each apartment once a month.

The ideal apartment-house has parks and tennis-courts in front and gardens behind

Each house is provided with open stairs, which are nevertheless protected from rain

Since Smith builds in such large quantities, he is able to turn out first-class houses at small cost. They all have hot water, steam heat, gas-ranges, and electric fixtures; yet Smith can turn them out at the rate of $25,000 apiece.



The houses are built on an arc of a circle, thus insuring light for all the tenants, at a moderate rental

Make Electricity Operate Your Wrench

"OUCH!" comes from beneath the jacked-up automobile.

"What's the trouble now?" asks the jovial neighbor.

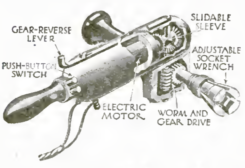
"That monkey-wrench slipped and I skinned my knuckles again!"

"Wait a minute," says the neighbor, and goes into his own garage.

Returning in a moment, he hands to his friend under the car an article resembling a vibrator, remarking:

"Let me attach the wire to this lamp-socket. Then you fit the chuck to the nut you want to loosen, pull the sliding lever toward the handle, and press the button of the switch."

A few minutes later a buzzing sound is heard, and the wrench begins its work. The four jaws of the chuck have been adjusted to the size of the nut by a few turns of the threaded choke ring or collar encircling them, the lever has shifted the gear to the reverse position, and by the pressure of the button switch the current has been sent through the armature of the elongated motor within the handle of the wrench. A second or two, and the nut is unscrewed.



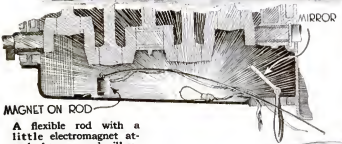
A handy tool in the garage; it will serve as a wrench, a drill, or a valve-grinder

Look at the accompanying picture and you will understand this better. A cylindrical casing has a handle at one end, and it incloses a small electric motor with elongated armature revolving between similarly shaped field-magnets. At the end of the shaft is a slidable sleeve with a bevel gear at each end. This sleeve can be shifted by a lever so as to engage either one of the gears with the bevel gear at the end of a worm-geared shaft which drives the shaft of the wrench. Within reasonable limits, the chuck of the wrench can be adjusted to nuts of various sizes, and, if the nut is in a position difficult of access, a wrench-bit having a universal joint may be used in the chuck.

What's New in

Here are many suggestions look them over and decide

This three-story ambulance, used by the army of Holland, holds seven or eight patients, but it must be very uncomfortable in bad weather

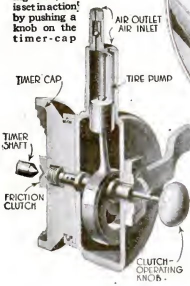


A flexible rod with a little electromagnet attached to one end will remove a valve-spring key from the crank-case after the key has been located by means of a mirror

If you want to be sure of finding your car where you left it before you went to lunch, equip it with a burglar alarm

Even a person without legs may drive an automobile provided with this hand-control of the clutch and brake-pedals

The air-compressor below is operated by the rotating timing-shaft, and is set in action by pushing a knob on the timer-cap

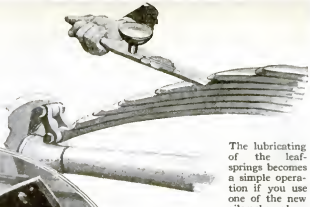


It is a good plan to test every electric light bulb on your car before going on a trip. Here is a new testing apparatus that is suitable for that purpose

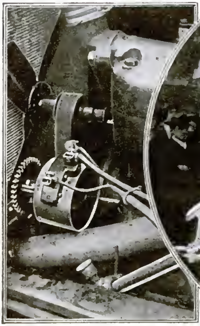
In case of back-fire, the collar of highly inflammable material, holding back the spring-actuated intake needle valve of the carburetor, flashes, stopping the flow of gasoline

the Automobile World?

for your convenience and comfort; which of them you ought to have



The lubricating of the leaf-springs becomes a simple operation if you use one of the new oilers shown here



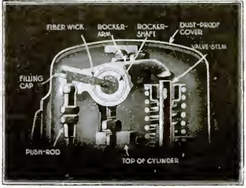
The rectifier shown above changes the alternating [current of the Ford magneto to direct current, which is then used to charge the storage-battery operating the lights

An up-to-date evangelist is touring the country in a specially built car that is equipped with a pulpit and a sounding-board, which may be folded down when not in use

The basket-like luggage-carrier shown above, though not very ornamental, is decidedly useful

This curtain window-light has perforations which fit over fasteners in the frame

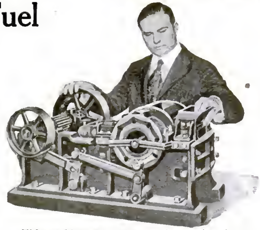
Always carry a megaphone with you when touring in your car. It is often very convenient for asking directions of persons at a distance



The rocker-arm shaft is hollow and filled with oil-soaked felt fiber to keep the rocker arms lubricated

Squeezing Peat to Make a New Fuel

It is done by a machine that also compresses merchandise for shipment

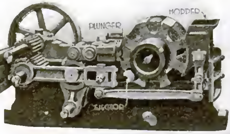


This machine can convert coal screenings into fuel or compress merchandise for shipment

THE compressing of merchandise for shipment will be employed extensively in the future, says William P. Michaelson, inventor of the machine shown here. He probably does not intend to include cut glass, china, or even high silk hats of the non-collapsible type; but there can be no doubt that the idea of reduction of the volume of commodities is capable of a wider application than hitherto. There was a time when loose hay and empty boxes made up an entire shipment; today the hay is compressed, and the boxes are not assembled until the destination is reached.

But the principal use of the machine is in making briquets for fuel. Such materials as peat, lignite, coal-dust, sawdust, and similar substances make good briquets when they are properly treated. The water can be forced out of the peat and applied to commercial purposes, while the peat itself can be utilized for fuel and in the manufacture of high-grade steel.

The molds used in the process (eight in number) are situated on a cylinder. The material for the briquets passes down through a hopper to a feed plunger, which fills the mold opposite. The cylinder then turns until the next mold is in place for filling. When a full mold has passed half way around, it is then opposite the compression piston, and is squeezed into a briquet. Automatic ejectors empty the mold. In this manner the process continues indefinitely.



Sectional view showing important details of new compressing machine

The revolution of the cylinder about its axis is intermittent, allowing time for the reciprocating parts to enter and leave the molds when in register.

It Pumps Grain Like Water

And does an enormous amount of work with a small number of laborers

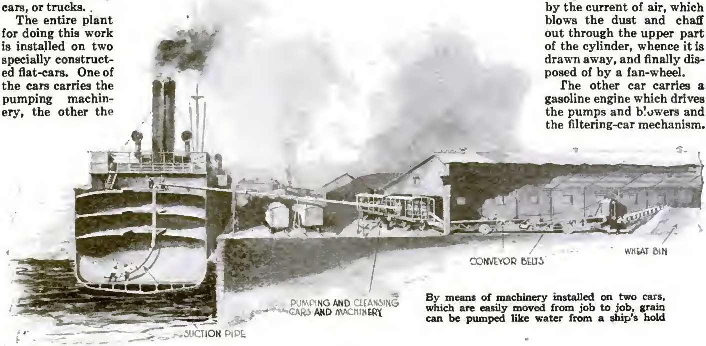
BECAUSE of the necessity of transporting enormous quantities of grain, and the lack of laborers to handle it during the war, a method for moving grain invented by Robert Boby came widely into use in Great Britain. The inventor treats the grain as if it were so much water. Powerful pumps suck it up from the holds of ships or barges, and, after cleaning it by suitable means, distribute it to bins, railway cars, or trucks.

The entire plant for doing this work is installed on two specially constructed flat-cars. One of the cars carries the pumping machinery, the other the cleansing machinery. A suction pump draws the grain through a pipe from the hold of the ship or barge. The grain is drawn into a reservoir on the filtering car, and is discharged upon a conveyor which takes it to the cleansing filter.

The sifter consists of bags of a specially woven cotton cloth, which may be used either dry or wet. The wet filter bags retain the dust, which, forming a doughlike mass, is removed from time to time. In the dry filter the dust passes through the cloth, and is blown away.

Another method of separating the dust from the grain is sometimes used. The grain is allowed to flow in a steady stream into a cylinder into which a powerful current of air is blown at an angle to the stream of grain. The grain is whirled around by the current of air, which blows the dust and chaff out through the upper part of the cylinder, whence it is drawn away, and finally disposed of by a fan-wheel.

The other car carries a gasoline engine which drives the pumps and blowers and the filtering-car mechanism.



By means of machinery installed on two cars, which are easily moved from job to job, grain can be pumped like water from a ship's hold

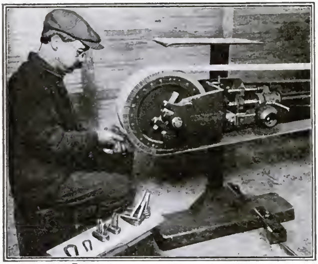
Finishing and Polishing Metal by Means of a Leather Belt

METAL-FINISHING is ordinarily done on a buffing-wheel. An abrasive belt machine answers just as well. The finish given by the belt is excellent, and great speed is obtained. In fact, the makers of the new machine claim that it turns out more and better work than is possible with any other finishing process. This is a broad claim, but the claimants offer to back up their words with facts, figures, and demonstrations.

In the picture below a mechanic is seated at his machine. He holds against the belt a small magnet which he is finishing and polishing. The belt has a speed of about 7,000 feet a minute. Its action is modified somewhat by the soft cushion-like pulley beneath, which pulley is made up of a cast-iron hub with side flanges into which are fitted approximately 225 leather blades.

The leather blades are bent slightly by the tension and the rapid movement of the belt, and the bending effect is increased by the pressure of the work. This action seems to give a better grinding and finishing effect, and is also an aid in carrying off the minute metal chips, which otherwise might clog the work or interfere with the finish.

The operation of finishing has always been an important one in the field of mechanics, owing to the wide application of the process in the fitting and polishing of castings.



Eill is finishing a small magnet. He holds it against an abrasive belt which travels at the rate of 7,000 feet a minute

© Kadel & Herbert

This is the "icycle"

Now Comes the Icycle

HOW can you use a bicycle in winter? The answer is given by a young New Yorker. He has simply removed the front wheel from his machine and substituted skates. Suitable braces and cross-pieces are made use of to accomplish the purpose in view, and the whole is given a gay and festive appearance by wrapping the braces with white cloth. Owing to appearance given by the white cloth, the altered machine has received the name "icycle."

When the icycle is taken for short trip on the frozen Hudson, two seats are added for the accommodation of the inventor's younger brothers. Thus the converted bicycle is made to carry three instead of one as formerly, and, according to the rules of arithmetic, three times as much fun is extracted from the machine as before.

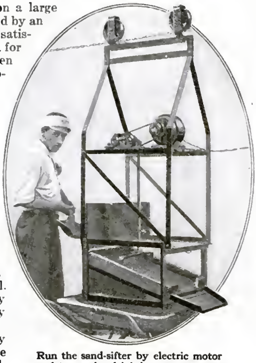
Sifting Sand for Concrete by Electricity

WHERE sand-sifting is done on a large scale, the use of screens vibrated by an electric motor has been found very satisfactory. A coarse screen can be used for removing the gravel, and a finer screen for the sand. Various grades can be separated by this means in a very short time, and the work is under the complete control of the operator.

Closing an electric switch is all that is necessary to start the work. Opening an electric switch is all that is necessary to stop the operation. The modern method changes a hard job into an easy one, at the same time lessening the cost. Such a method is therefore all that could be desired.

Even a very small motor will cause sufficient vibration to perform considerable work of this nature. A 1/8-horsepower motor will operate quite a large screen and do the work well. Vibratory motion is produced by means of a small tapper operated by the motor.

In speeding up concrete and foundry operations, the sand-sifting must be under complete and accurate control.



Run the sand-sifter by electric motor and turn a hard job into an easy one

Clean Your Typewriter with a Blow-Torch

TO give your typewriter a thorough cleaning, why not use a gasoline-torch?

First take the typewriter outdoors and remove the ribbon. The platen should be either taken off or covered with paper. Having filled the torch with gasoline, pump up a good pressure and open the needle valve. A fine jet of gasoline will be projected with such force as to reach the most inaccessible parts of the machine.

One filling of the torch, if it is a good-sized one, is generally enough. After the machine has become dry, it is a good plan to spray the working parts with a good lubricating oil.

Needless to say, cleaning with a gasoline-torch should be done in the open air, and one should not smoke.

He Was Mummified by Natural Causes

A MUMMY different from any other in the world is on exhibition in the Museum of Natural History in New York City. It is believed to be the only one of its kind ever found. It was discovered in the province of Antofagasta, Chili, and is the mummy of a Chilean Indian who was buried in a cave-in while engaged in mining copper, in prehistoric times. The body, being protected from the air, became mummified through the action of the copper salts, aided by the extremely dry climate of the region.

With the mummy were found the stone wedges and stone hammers with hafted wooden handles used in mining, and baskets and a bag of llama skin for holding the mined ore.

Growing One-Foot Trees for a Japanese Garden

IN a two-foot dish a Japanese will make for you a perfect garden—summer-houses, bridges, Japanese maidens, and trees.

The bridges, houses, and maidens are the result of careful, delicate workmanship, but how about the living trees? They are perfect one-foot grown-up trees. Some of them have lived two hundred years and will never grow any taller. They are cultivated dwarfs.

To get this result, when a Japanese tree starts growing, all of its healthy, robust branches are cut off, and the weaker one lives on. This operation is performed again and again on all fast-growing branches. In time they give up trying, and only the small, frail ones survive.

This Six-Foot Bowl Is for Stew

CHIEF cook for the Indians of Vancouver Island makes no complaint when a festival is announced, for Indian festivals are not elaborate eight-course affairs like ours. The cook need only add several potatoes and carrots to his already cooking stew and serve it up in a large bowl.

The size of bowl and the number of quarts of stew depend on the importance of the festival; and so a very large affair will call for a bowl like the one shown above. This one is carved out of wood, and when placed on end is at least six feet tall. The symbol for the clan to which it belongs is carved at one end.

It takes so long to serve the stew that hot stones are dropped into the bowl from time to time.

Ants Invade a Camera and Overrun a Film

EMPLOYEES of an America mining company operating in central Mexico were driven off their property by revolutionary bandits a year ago, leaving most of their belongings behind them.

When the president of the concern returned six months later, he found his camera unharmed and still loaded, and proceeded to take a photograph of the company offices. An exposure showed this remarkable picture.

Shooting a Stitch in Time from a Sewing Cartridge

THAT old adage that praises the stitch in time as a labor-saving device appeals with particular force to the camper or woodsman miles away from a tailor or feminine aid. Many woodsman, like most sailors, are good needlemen; but, where the tar has always needle, thread, and palm (the sea version of a thimble) in his ditty-bag, the woodsman is often without the "mending makings." Now, as our picture above certifies, he has only to put one more cartridge in his belt to be ready for rips and tears. The bullet unscrews, and out come cotton, needles, and thread. Each bobbin—one wound with white and the other with black—holds two needlefuls.

Piling Up Coal with a Triple Conveyor

TO simplify the work of piling up coal in railroad yards, a triple-conveyor apparatus operated by electricity, is now employed. The first conveyor carries the coal up a certain height, and lets it fall on the second; that, in turn, carries it up another height; whereupon the last conveyor link brings it to the top. The coal-piles sometimes reach a hundred feet in height by means of these triple conveyors.

A Weather Clock Used on Zeppelin Hangars

MUCH of the old-time sea-captain's knowledge of wind and weather, reinforced by sound science, is demanded of the captain of a giant Zeppelin.

As a rule, before starting out, the first thing that a Zeppelin commander does is to look at the indicator that is placed at the top of every Zeppelin shed. It tells him not only the direction of the wind, but also how many meters a second it is blowing. Thus informed of the local conditions, he next consults the charts especially prepared for aeronautical use by the German meteorological office. With the weather conditions all over Europe clearly set down, he sails off into the blue, knowing exactly what he has to expect.

Swimming in an Inner Tube

MOST tender parents will not throw their children overboard in order to teach them how to swim. Instead, they make sure that their children won't sink by buying them buoying water-wings and life-preservers. But the economical automobile-owing parent shown below has turned one of her inner tubes into a life preserver, and her child is swimming in it.

If you think this a remarkable use for old automobile tires turn to the first of the prize-winning contributors in our "Old Tire Contest," in this issue of POPULAR SCIENCE MONTHLY. Our readers found more than two hundred and fifty ways of using old tires, and they're all worth knowing.

The Hotel de Rover—for Fashionable Dogs

NEW YORK has a hotel for dogs. Ranged about the spacious reception-room are kennels where prize pets have been left temporarily while their masters are out of town. The bull pups are in the majority, and there is always one in particular that tries to attract your attention and be interviewed.

All the dogs are well cared for in their hotel. They are cleansed, trimmed, beautified, or prepared for exhibition; for many of them have taken handsome prizes, and will take more. No sick ones are received. The hotel is not a hospital. Only the nobility and brains of dogdom are registered at this hotel.

Lifting Sunken Treasure from the Sea

Ships and cargoes worth billions were sunk by the Germans. Can that treasure ever be recovered?

By Walter Bannard

According to an official statement issued by the United States Shipping Board, the Allied and neutral nations lost 21,404,193 dead-weight tons of shipping during the war, which means that Germany maintained an average destruction of about 445,000 dead-weight tons monthly. Most of the ships that were torpedoed undoubtedly lie under water at both low and high tide. Without the aid of a diver, they would remain there until they literally dissolved. And so divers must be sent down—exceptional men, amazing men, who perform under-water feats of physical endurance that seem well-nigh incredible, and who accomplish tasks in carpentry, fitting, and blacksmithing that seem little short of miraculous to the untutored layman.

Man Lives in an Air Ocean

Man is an animal that lives at the bottom of an ocean of air. Like the water of the sea, the ocean of air has weight. At sea-level it presses upon you with a force of fifteen pounds to the square inch. Nature has fashioned you so that you can eat and sleep and walk about when the pressure of the air upon you is somewhat less or somewhat more than fifteen pounds to the square inch.

But there are limits. Some deep-sea fish literally explode when they are brought to the surface: the water-pressure to which they are accustomed has been removed. You will not explode if you are raised by a balloon to a height of five miles, but you are likely to die for lack of air.

All these facts must be borne in mind when one considers what is demanded of a diver. To send him down in order that he may explore a wreck is not so much a matter of preventing him from drowning as it is a matter of air-pressure. He must breathe under conditions that were never considered by nature. A cubic foot of salt water weighs sixty-four pounds.

The deeper a man descends, the more cubic feet of water press upon him. For every foot that he goes down, the pressure increases about half a pound to the square inch. Clearly, a depth is soon reached at which he would literally be squeezed into a pulp, assuming that the water can not enter his body. He would be "imploded"—the opposite of exploded.

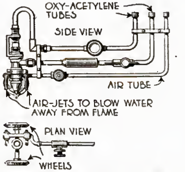
The purpose of the diver's dress that will be used by hundreds of men in raising some of the treasure now at the bottom of the ocean is not only to prevent drowning, but to offset the pressure of the ocean by pressure of air.

Why the Diver Is Not Squeezed to Death

A diver's dress consists essentially of two parts—an incompressible helmet and a compressible garment for the body and legs. Down and down the diver goes. The pressure increases. It tries to force the air out of the dress into the helmet. Air must be pumped into the helmet and the upper part of the dress until the pressure within is equal to that without at the level of the breast. The man breathes; he exhales a poisonous gas—carbon-dioxide. An escape must be provided for the exhaled poisonous gas, as well as to prevent the air-pressure within from increasing beyond a desired degree. So an automatic outlet valve is provided in the helmet.

Blown up with air as he is, a diver is like a bubble: he must be sunk. Hence he carries about eighty pounds of lead on his body and sixteen pounds of lead in each boot. His dress, exclusive of himself, weighs about 175 pounds.

Air is supplied by means of a flexible hose connected with an air-pump in a boat above, or with a compressed-air tank. Besides the air-hose, the diver is usually connected with the



This is the oxy-acetylene torch, which melts steel under water—the invention of Brusch and Beyer. A jet of air blows away the water, so that the flame can reach the steel; it also guides, and steadies the flame of the torch

Cutting away wreckage is the chief function to be performed by the oxy-acetylene under-water torch. In the future the torch will be used, wherever it is possible, instead of dynamite

Floating Her with Big Cans of Air

Sometimes pontoons (huge especially constructed steel cylindrical tanks) are sunk beside the vessel and fastened in place by divers. The water in the tanks is then pumped out. Such is the buoyancy of the pontoons that the vessel rises. As a general rule, the diver first tries to clear away wreckage, which is done by means of an under-water oxy-acetylene torch or by dynamite, and then closes all the large holes. How does he stop an opening made by a torpedo? Its general shape and size must be known. With the aid of an adjustable mold of wood, the diver indicates the general size and shape of a patch that will fit the holes. Next the patch is constructed of steel plates or planking, lowered, and drawn into place by cables outside and inside of the hold

A cofferdam is simply a water-tight wall built up from a submerged portion of a ship. When it is pumped out (the leaks in the hull having all been plugged), the ship rises by virtue of her own buoyancy, as well as by that added by the cofferdams

surface by a signal line or life-line in which telephone wires are embedded. He descends by a "shot-rope"—a rope sunk by a heavy weight or a shot.

It is evident that much depends on the air-supply and the air-outlet valve in the helmet. The deeper the man descends, the more air must be supplied, since the pressure must increase with the pressure of the water. If the pumps are supplying one cubic foot of air a minute when the diver is near the surface, they must supply two cubic feet at thirty-three feet, three cubic feet at sixty-six feet, four cubic feet at ninety-nine feet, etc. As the pressure increases, curious disabilities appear. The diver cannot whistle, for example, because he cannot make his lips vibrate. His voice, heard over the telephone, becomes strangely shrill and squeaky.

Moisture condenses on the front glass of the helmet. He cannot see. He sucks in a mouthful of water through a tap (the "spit-cock") and spurts it over the inside of the glass. It is washed down, and all is clear again.

The Record for Diving

How deep can a diver descend? The record is about three hundred feet or thereabouts, made by divers of the American Navy when the F-4 was raised some three years ago in the waters of Honolulu. At that great depth little work can be done; the diver can do little more than grope around.

The air is composed of about eighty per cent nitrogen, a gas that does not readily enter into chemical composition with other elements and which serves the purpose of diluting the oxygen of the atmosphere so that we may breathe it in the proper amount.

The Perils of High Pressure

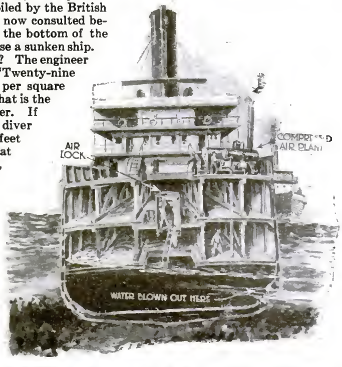
At high pressure the nitrogen penetrates the blood; it is not chemically converted into something else that is breathed out, as in the case of oxygen. The deeper the diver descends, the more nitrogen is forced into his blood and tissues. If he is brought up from a great depth too rapidly the nitrogen bubbles off; the man suffers agonies; he has all the symptoms of "caisson disease" or the "bends"; he may die.

A table was compiled by the British Admiralty, which is now consulted before sending men to the bottom of the ocean in order to raise a sunken ship. Is the depth 66 feet? The engineer refers to his table. "Twenty-nine and a half pounds per square inch," he reads. That is the pressure of the water. If by any chance the diver descends to 192 feet and remains at that depth over one hour, the process of bringing him up will be tedious. He will be held for five minutes at a depth of eighty feet; for twenty minutes at a depth of seventy feet; for twenty-five minutes at sixty feet; for thirty minutes at a depth of fifty feet; for thirty minutes at forty feet; for thirty-five minutes at thirty feet; for forty minutes at twenty feet; and for a final forty minutes at ten feet. In all, three hours and forty-five minutes must elapse between the time that the man starts to come up and the time that he is clear of the water, in order that the nitrogen may be slowly and safely released from his system.

Problems for the Salvor

How does the diver ascend? He tightens up his air-valve. His buoyancy is increased. It becomes possible for him more or less to float up the shot-rope. With each foot of ascent the volume of air in the dress expands; the speed is quickened. At first the legs and arms can be moved easily enough, so that the diver can hold the rope and adjust his valve to suit the changing conditions. Soon the dress blows up hard as a board; he is as helpless as if he were shackled; he cannot reach out and adjust the valve. What, then, becomes of the excess air? It escapes through the cuffs.

There is no magic procedure applicable to the salving of every wreck. A salvage engineer must study each case on its own technical merits, and he must invent the peculiar technique that is to be followed in a given instance. Just as a surgeon must consider the age, structure, physical strength, and vitality of a patient, so must the salvage engineer take into account the position of the foundered vessel, the nature of the extent of the damage she has sustained, and the

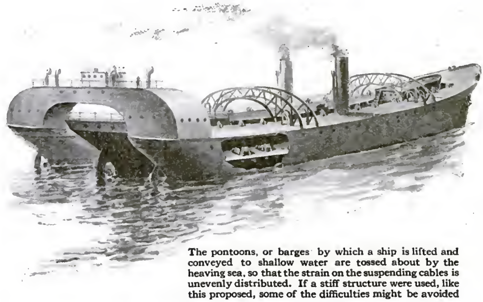


The air that is pumped in blows the water out through a convenient vent, and sometimes through the very leak through which it entered

character of the salvaging machinery that is at his disposal.

The methods which were employed in salvaging one ship are not likely to be applicable in every respect to the raising of another. The salvor must be able to estimate the weight, trim, and stability of a ship in her damaged condition, and quick to form a plan of operation, taking into account the position of the vessel, the nature and extent of damage which may have been done, the tide and currents of the water in which she lies, and the character of the plant at his disposal.

If a ship cannot be raised, at least her cargo may often be salved. With pneumatic drills or with the oxy-acetylene torch (a blast of air keeps the water away from the flame) a hole can be cut in the plating of a ship as she lies on her side, and through that hole her cargo can be raised. Is the cargo steel? Then the electric lifting magnet is lowered. It fastens itself with leechlike tenacity to as much as it can carry. Gold, copper, silver, must be raised by other means. Orange-peel and similar buckets will raise coal and other bulk cargo.



The pontoons, or barges by which a ship is lifted and conveyed to shallow water are tossed about by the heaving sea, so that the strain on the suspending cables is unevenly distributed. If a stiff structure were used, like this proposed, some of the difficulties might be avoided

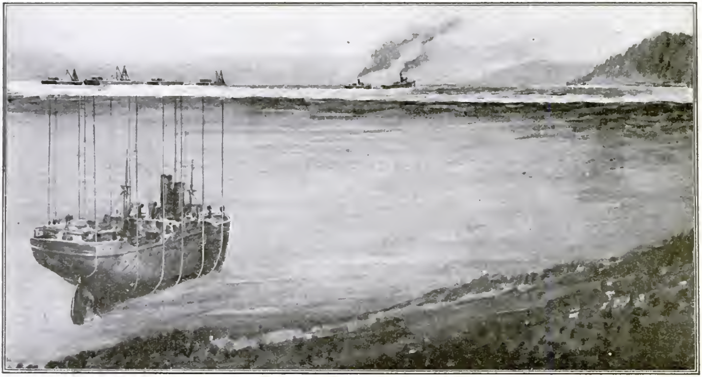
The Case of the "Lusitania"

The quickest way of entering a hold is to dynamite an opening; but nowadays that method is resorted to but rarely because the tangled mass of wreckage that results imperils the diver and makes his work more difficult. Perhaps that is the method that may be employed to salve the cargo of the *Lusitania*. The ship herself is probably irrecoverable; for she lies at a depth of 300 feet in the open water.

Ships of under 2,000 tons are usually raised by slipping under them chains or cables, which are fastened securely to barges or hulks at the surface.

As the tide rises the vessels at the surface also rise, lifting the ship below, by means of the chains or cables. The barges are then towed into shallower water, and the chains are tightened. At the next rise of the tide the process is repeated.

Sometimes pontoons (huge specially constructed steel cylindrical tanks) are sunk beside the vessel and fastened in place by divers. The water in the tanks is then pumped out. Such is the buoyancy of the pontoons that the vessel rises. Large ships have thus



Ships of less than 2,000 tons are usually raised by slipping under them chains or cables, which are secured to barges or hulks at the surface. As the tide rises, the vessels at the surface also rise, thus lifting the ship below by means of the cables. The barges are then towed into shallower water and the chains are tightened. At the next rise of the tide the process is repeated. And so, after days and days of patient waiting for the tides and patient tightening of the lifting chains or cables, the foundered ship is at last beached. It is easy then to pump out the ship and to patch her

been raised—for example, the British cruiser *Gladiator*, a ship 320 feet long, displacing 5,500 tons.

As a general rule, the salvor first tries to clear away wreckage, which is done by means of an under-water oxy-acetylene torch, or by dynamite, and then closes all the larger holes.

Weight of the Sea

The sea's weight affects not only the diver but the sunken ship. Pile cubic foot upon cubic foot of water, and it follows that at the deepest part of the ocean the pressure must be measured by tons to the square inch. At sixty feet, for example, the pressure is 26.7 pounds to the square inch; at one hundred and fifty feet 66.7 pounds; at three hundred feet 133.3 pounds. The raising of a sunken ship is complicated not only because its hold is inundated with water, but because of this weight.

How fast can a man in a ordinary dress work under water? A one-inch hole can be drilled in mild steel at the rate of one to one and a quarter inches a minute. An inch hole can be bored into timber with a pneumatic auger at the rate of three to six inches a minute.

"England's Need"

When German submarines were torpedoing ships at the rate of several hundred thousand tons a month, a German magazine published this boastful map. The little marks indicate the sunken ships. The map serves our purpose to prove how rich is the opportunity of the salvor

How is the opening made by a torpedo closed? Its general shape and size must be known. With the aid of an adjustable mold of wood, the diver indicates the general size and shape of a patch that will close the hole. Next, the patch is constructed of steel plates or planking, lowered, and drawn into place by cables outside and inside of the hold. To secure a patch in place, bolts are employed.

Instead of patching holes and pumping out a ship, the salvor may decide to blow the water out of her. In other words, he opposes air-pressure to water-pressure, exactly as air-pressure is opposed to water-pressure in the diver's dress.

The first step is to brace or strengthen the decks, so that they will not burst as a result of the airpressure. Port-holes, funnels, all the openings, are tightly closed. The next step consists in providing access to the compartment. What is called an air-lock is applied to the cover of the hatchway. An air-lock consists simply of a chamber that has a door communicating with the outside and a second door communicating with the hold.

The diver enters and closes the outer door behind him. He then passes through the second door into the hold, and closes that door behind him too; for the hold is full of compressed air which must not be allowed to escape in too great quantities.

These air-pressures must be carefully considered by the salvage engineer. The decks of a ship are not intended to support thousands of tons of water. Hence it is often necessary to shore a ship so that when she is pumped out they will not collapse. And this shoring must be done in inky blackness.

The openings closed and the air-lock in place, air is pumped in. The pressure of the air must be greater than that of the water. Gradually the water is blown out through a convenient vent, sometimes the very leak through which it entered; but the salvor usually relies upon a scupper-pipe.

Allies' Salvage Plans

That a systematic effort will be made to raise the ships that can be salved may be inferred from the fact that not only have the United States and the Allies studied the problem individually, but that they have pooled their salvage facilities and formed a joint salvage council. Fully one quarter of the world's shipping lies at the bottom of the ocean.

Ships and cargo sunk by mine and torpedo are worth about three billion dollars at present market prices for labor and materials. Up to date the British Salvage Department has salved more than 470 ships. But most of them were recovered before they had actually sunk.

Raising Ships of 2,800 Tons

Before the war it was considered impossible to salve vessels of more than 1,600 tons if they lay in deep water; but since the war vessels of 2,800 tons have been raised.

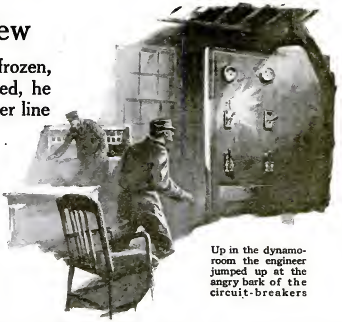
Most of the ships that went down were sunk in open water. It is considered a feat to raise a ship in a protected harbor, if she lies in a hundred feet of water. But out in the open the depth must be less than a hundred feet, particularly in a region where the winds are high and the sea rough, if salvage operations are to be successfully conducted. Only those ships which have been sunk close to shore in a more or less sheltered position are likely to be raised. The commercial risk in the open is too great.

It looks as if someone had taken a sledge-hammer and tried to flatten these cans of vegetables. But it was the enormous pressure of the water and its great depth that "imploded" them. They formed part of the cargo of a torpedoed ship

When the Breakers Blew

Locked in a cold-storage room, half frozen, unheard when he pounded and pounded, he saved himself by short-circuiting the power line

By Charles Magee Adams



Up in the dynamo-room the engineer jumped up at the angry bark of the circuit-breakers

IT had been fine and cool when he had first gone in. Outside it was 105°; inside, freezing cold. The contrast was agreeable: so Charlie Grant had worked on his job of installing new lamps with a sense of relief from the summer weather.

But after a while he grew colder and colder. He wished that the door had not been tightly closed. But the man outside had been very careful about that, so as to keep the room cold.

Charlie worked on, pulling his jumper up around his neck, and occasionally stopping to warm his hands over a newly lit lamp.

Occasionally he stopped to beat his arms against his sides to warm them. But he saw quicker relief from the cold in working fast and getting through his job and then going out again into the 105° of the street.

Five more lamps to put in. He yanked out the old carbon filament bulbs and rapidly substituted tungstens for them. He replaced the protecting glass globes and fastened them down on the rubber gaskets and washers. Thank goodness, he was done. He gathered up his empty cartons and carbon bulbs, and took a look at the rows of lighted tungstens: every one was burning brightly. His task was done. So he made a bee-line for the door, almost running in his hurry.

The Door Would Not Open

Reaching it, he set down his cartons and old lamps and tried the lock. It would not open. Then he remembered that the man who had let him in had locked it purposely. The door had to be kept tightly closed and the room cold, the man had said. He would come back and let him out.

Charlie rapped on the door, hoping to attract the man's attention. But his fists on the door only gave back a heavy thud which was hardly audible. He listened for footsteps or sounds, but he could hear nothing but the far-away hum and thump of the machinery in the power- and pump-rooms.

He looked at his watch. It was just three minutes of six. He had been in there almost a half hour. Why wouldn't that fellow hurry? To be sure, he was being paid overtime, but he wanted to get home to supper. Besides, it was getting mighty cold without anything to do to warm the blood.

Trapped in a Dungeon

He tried to warm himself by the heat from the tungsten bulbs; but so little heat came through the outer glass that he gave it up and went back to the door and pounded again. No response. He looked at his watch again. It was 6:10—thirteen more minutes. His teeth chattered and the chill penetrated his scanty overalls and jumpers.

Was there no means of escape? The room was underground, and there were no windows. The ventilator-pipes that led upstairs were too small to allow him to crawl through them. After a tour of inspection he came back to the door once more. He simply must get out of that cold.

Still there was no sign from the door. He pounded in an effort to keep warm, but the pounding only bruised his cold fists. He tried the lamps again in desperation, but they warmed only a couple of fingers at best.

If only he had some way of attracting someone's attention! He looked for a bell or signal line. There was none. The only communication with the rest of the plant was the frost-covered ammonia-pipes and the lighting and power conduit. He tried tapping on the pipes, but the frost deadened the blows to nothing. The conduits were too firmly strapped to the walls and ceilings to carry the sounds readily.

What Could He Do?

What could he do? He felt that he would have to act quickly—his fingers and feet were growing numb. One of the wire ropes was just overhead—a big two-inch conduit that carried the power wires from the dynamo-room to an auxiliary pump-room at the

A sputtering flash, followed by total darkness: he waited anxiously in the intense, bitter cold

other end of the building. As he looked he had an inspiration.

He followed the pipe along its course, and finally found an iron junction-box where the small conduit for the lighting of the room branched from the big pipe. Working quickly, he dragged up a packing-case full of frozen goods under the iron box, and with his pocket screwdriver quickly pried off the lid.

The next thing was to get at the wires. But they were embedded in a hardened insulating compound which had been poured molten into the box. The cold had numbed and stiffened his fingers until it made him awkward. But he chipped and cut and pried until the two big wires were visible.

He Had a Plan

It was just seven o'clock. He worked on. The lead covering on the outside of the cotton insulation offered some difficulties, for his fingers were becoming more and more clumsy. But finally the stranded copper lay bare before him in in the bright light of the lamps.

He knew that the power was on, for the pumps were run constantly. His plan was to short the circuit of the wires and thereby blow out the breaker in the dynamo-room. These circuit-breakers were little magnetic devices which automatically opened the circuit when the load on the dynamo became too heavy. By this means he could attract the attention of the engineer, who would look for trouble if the breakers blew too often.

Again he pulled out his big pliers and laid them across the wires. Another flash, and more darkness—this time permanent darkness

He pulled out his big pliers, and laid them across the two wires. A sputtering flash. Then total darkness. He withdrew the pliers in the cold darkness and waited. The lights glowed again in a minute. Again he pressed the pliers to the wires. Another flash and then darkness. Four more times this happened in quick succession, and then darkness—permanent darkness.

An Interruption

Up in the dynamo-room, Burke, the engineer, was disturbed in his perusal of a popular magazine by the angry bark of the circuit-breakers. He rose and, pulling out the main switch, he pushed in the breaker and then threw in the switch. He had just resumed his seat when the breaker blew again. Again he rose and replaced the breaker and switch. Clearly there must be trouble somewhere. The plant telephone rang. He picked up the receiver.

"What's the matter with the power?" asked an irate voice.

"Say, Carson," he called to a man passing the door, "give me your key to the underground room; there's trouble on the line somewhere down there."

Carson reached for his keys. "There's a man there working on the lights; ask him about it. By George!" he added. "He's been there almost two hours. I forgot to let him out."

Moving an Invalid Without Torturing Him

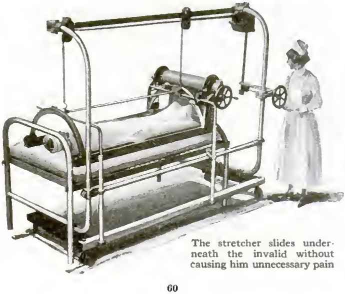
Every hospital ought to have this apparatus

"THIS patient must be taken to the operating-room at once. Use that new carrier."

The surgeon at the emergency hospital turns from the groaning victim of an automobile accident to the head nurse standing by his side.

A few minutes later a strong framework on casters, with a superstructure consisting of two curved arms, like the davits used on vessels for lowering lifeboats, is wheeled to the side of the bed. The two arms are connected by a heavy tubular bar, from which a stretcher-frame is suspended by chains running over pulleys. The stretcher-frame is lowered over the patient, with the poles of the stretcher along the sides of his body.

The patient is lifted from his cot a few inches. An attendant, standing near the foot end of the apparatus, begins to turn a wheel, and the end of the stretcher, which consists of a series of flat metal strips held between two layers of rubber sheeting, begins to move from the drum on which it is wound, toward the patient.



The stretcher slides underneath the invalid without causing him unnecessary pain

It is slipped under the feet of the man. As the attendant continues to turn the wheel, the stretcher is slowly slipped under the body of the sufferer. The edges of the stretcher slide in grooves of the longitudinal poles of the frame.

A few turns of another wheel lift the stretcher, with the patient, off the cot, and the apparatus with its load is moved to the operating-room, where the operation is reversed and the patient deposited upon the operating-table.

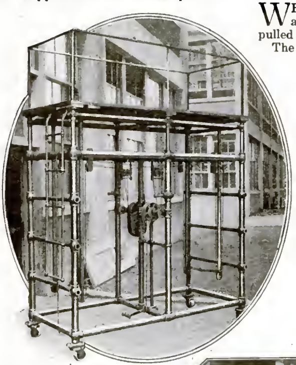
This carrier, an invention of H. Vizents of Chicago, has been satisfactorily tried out in several hospitals.

It Puts the Workman Close to the Job

IN those places where large pieces of machinery are built, it is frequently necessary to use elevated platforms or scaffoldings for the men who have to mount or adjust the machinery on which they are working.

These platforms or scaffolds must be very strong, and they must be easily moved and adjusted to different heights. The accompanying picture shows an adjustable platform which was invented and constructed by a workman in the shops of a Western concern engaged in the building of machinery.

The framework of the platform consists of pipes and fittings of different sizes. The lower part of the framework is made of six standards of heavy pipes, connected by horizontal frames of the same material. The platform proper rests upon a framework, the six supports of which telescope into the corresponding standards of the lower framework.



This adjustable platform, or scaffold, is used by men working on tall machines

The platform can be raised or lowered by wire cables running over pulleys, and operated by a winch provided with a band-brake.

The whole structure rests upon big casters, which make it possible to move the platform to any point where it may be needed by the workman.

Large cakes of ice are pushed against a gang of motor-driven saws and cut into small square blocks; to start and stop the motor, you merely throw a switch

Horseless Ice-Cutting

WHY are the blocks of ice that the iceman juggles so mathematically alike and regular in shape? They have been sawn. Usually the saws are pulled by horses. Now, however, machines are doing the sawing.

The marking is done with an electric marker operated by one man. Then comes the field cutter, a light, plowlike device with a circular saw operated by an electric motor carried on a truck. Current is supplied from a power plant. To start and stop the motor you merely throw a switch conveniently placed near the handles of the truck. One man can easily steer and operate the cutter.

This motor-driven cutter can be used on ice that would be too thin to bear the weight of a team of horses. Besides, the ice is not in danger of becoming contaminated by the horses.

The ice is not cut in square blocks by the field cutter, but is divided into large floats, and these are pushed against saws.

Carrying Light to the Farmer

ONE of the main reasons for the growing demand for electric lights in farm-houses far removed from any source of electricity is the progressiveness of the dealers selling portable farm-lighting apparatus. Instead of making the farmer go several miles to town to see such equipment, some of the big dealers actually take the equipment to him by means of a delivery motor-car, and start the apparatus running so that he may judge of its merits right in his own home.

In some instances the equipment is left in the truck, and wires simply led to the dining-room of the farm-house. In others the equipment, which usually consists of a small gasoline engine, a generator, and the necessary switches or panel-board, is temporarily set up in the house and left for one or two nights so that the farmer may become intimately acquainted with it.

Because of the great speed of the light motor-truck, many farms can be visited in a week, and greatly increased sales have resulted from this modern automotive method of merchandising.

Salesmen for farm-lighting apparatus motor their wares to prospective buyers whose farms are distant

Creation's Dawn at the Merry-Go-Round Zoo

How the animals that children love are started on their dizzy career

Carrousel animals are built up gradually — body first; head, arms, legs, and tail later. Here is a head in the making. It was built up of blocks of poplar wood glued together and then cut out in profile on a band-saw. It has just been turned over to the carver, who is hammering out hair, teeth, eye-sockets, and other things by means of his mallet and chisel

Eyes are not glued but wedged into a socket smaller than the eye

These lions are getting their last coat of paint before starting out in the world. In spite of their ferocious faces, their job is tame —simply whirling round until they fall apart with age

These gilded wooden tigers are not going to bite anybody. They can't—they have lockjaw

Carrousel horses are a lively crowd of high-steppers. They either gallop along, frothing at the mouth, or trot briskly, head down, straining at the bit, feet high in air. It's a wonder the hostler is able to varnish them

The body is cut out in profile on a band-saw. Head, legs, and tail all have pegs which fit into holes in the body. When all appendages are finished they are attached, and the body is then carved to suit

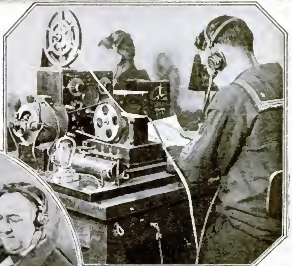
A store-room full of impatient animals waiting to be drafted into service. The cats up front (yes, they are cats) are equipped with a square meal. The rest of them will have to fish for themselves

Making the Wireless Talk Faster

Several messages can now be sent at one time from a single mast

Photographs © International Film Service

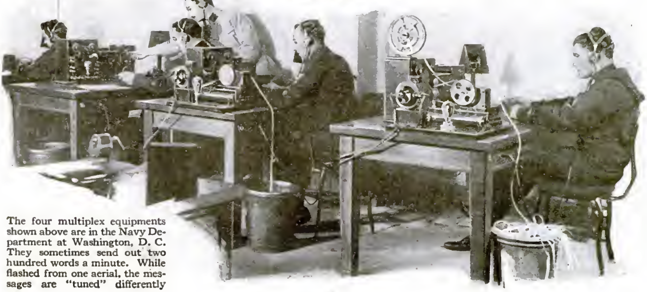
By means of multiplex radio-telegraphy, several different messages may be sent and received at the same time. Perforating each message on a roll of oil-paper tape constitutes the initial operation



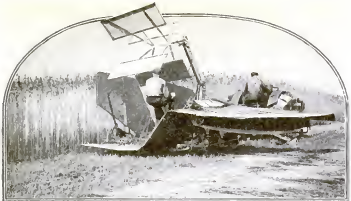
The perforations are a series of dots in double rows. Each series represents a letter of the alphabet. An electric motor feeds the tape through the "transmitter," where metal fingers feel the tape and pass through such holes as they find to make electric contacts, closing the radio circuit faster than could be done by hand

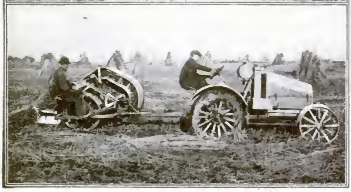
Besides the transmitter, the operator has a standard receiving outfit. Four or more of them are connected with a receiving aerial separate from the one used for transmitting. By manipulating the knobs on the receivers, each man can select a different message

President Wilson used the multiplex system on his voyage to France. Secretary Daniels is here shown preparing a message to Admiral Sims



The four multiplex equipments shown above are in the Navy Department at Washington, D. C. They sometimes send out two hundred words a minute. While flashed from one aerial, the messages are "tuned" differently





The gather-binder and the harvester have made the hemp crop pay from $40 to $60 an acre

How to Make the Hemp Crop More Profitable

BEFORE the year 1917, very little machinery was in existence that could be used with profit in harvesting hemp. A hand hemp-hook could be used to cut about an acre a day, but at that rate the crop was not sufficiently profitable to induce the farmer to plant extensively.

Then the agricultural machinery manufacturers came forward and brought out the harvester and the gather-binder. The harvester cuts the hemp close to the ground to preserve as much of the stalk as possible, and then spreads the stalks in regular rows, to be left on the ground for two or three weeks. While the stalks are thus spread out, a partial decomposition called "retting" begins, and this aids in the separation of the fiber.

The United States hemp crop for 1917 had an acreage of 50,000 and produced approximately 50,000,000 pounds of fiber.

When Surveying Must be Done Upside Down

WHEN an electric light company was constructing two cable tunnels near Boston, the ordinary methods of surveying had to be dispensed with on account of interference with construction trains and other traffic. The diameter of these tunnels is only seven feet; hence the complete avoidance of traffic interference was an impossibility.

Anyone who has ever seen a surveyor set up his transit will appreciate the difficulties under which his work was done. Just as the operator would get the instrument carefully leveled, there would sound a sharp whistle, and the man and his instrument would have to make a quick exit.

At last a novel plan was hit upon by which both traffic and surveying could proceed with very little interference. The transit was simply used upside down, attached to the roof of the tunnel. Blocks of wood, inserted in the roof at intervals of about two hundred feet, were used as sockets to which the transit could be attached. The instrument then hung down within a foot of a passing train, clearance enough to save the transit. And the surveyor? Well, he had to trust to his own acrobatic skill.

Of course, all this was not so easy as the mere telling of it. It is astonishing how complicated our work becomes when we have to do it just backward. The surveyor had to bear in mind that even the leveling screws must be turned in the reverse direction. Then, the bubble in the spirit-level had an annoying way of hiding itself, so that its tube had to be reversed just to accommodate the laws of gravity. In spite of all, this surveyor completed his job.

To prevent interference with traffic, this surveyor attached his instrument to the tunnel roof

Roads, Like Shoes, Polished by Cloth

SOME of the concrete road-making inventions appear to the casual observer like huge boot-blacking machines. Slowly, back and forth, a big belt is dragged across the cement surface, smoothing and finishing it in much the same manner that a shoe is polished.

A tamping device with an up-and-down movement pounds the concrete into a solid mass and squeezes out the excess moisture. A long, hard stroke is used at first, followed by a short, rapid movement that subjects the concrete to continuous agitation without pressure. An arch-shaped scraper or strike-off gives the desired contour to the road-bed as the machine moves forward under its own power.

This self-propelled machine arches, pounds, or tamps the concrete, and smooths it with a belt

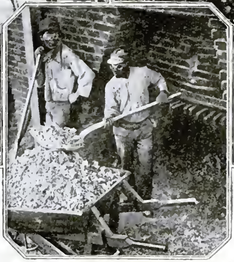
In speeding up road-building this machine has proved a success. A concrete without excess of water can be used, whereas with the hand-roller process a slight excess of water has to be used to keep the concrete from getting too stiff to work. Since an excess of water tends to reduce the strength of concrete, the new method should prove desirable.

Even Pearl-less Oyster-Shells Are Valuable

Photographs © Underwood & Underwood

This is a pile of oysters. The oysters will be canned and the shells burned, for burned oyster-shells make excellent fertilizer

Oysters are raked up from the bottom of the sea. Their shells have just become valuable because of the nitrate discovered in them



This is how the shells look after they have been through the fire. The wheelbarrow will take them to a conveyor which will send them to the pulverizer

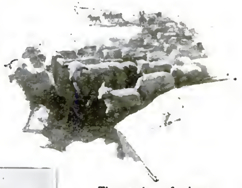
Finding Valuable Food in Beet-Sugar Waste

THERE are many kinds of beets, and they have just as many uses. We are all familiar with the garden variety which we eat as a vegetable or in salad. The sugar-beet has been grown for its sugar alone, and has been so well cultivated that it is just as valuable as cane-sugar if you compare one ton of beet root with one ton of sugar-cane.

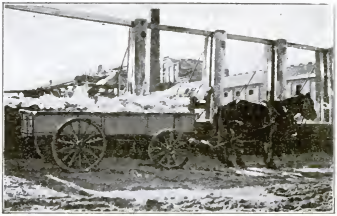
Immense quantities of refuse from sugar-beet factories in the Western States, formerly considered waste, are now fed to cattle and sheep as a fattening ration. The pulp of sugar-beets remaining after the sugar has been extracted looks something like sauerkraut. It has been found to have about the same content as corn silage, except that it contains more water and not quite so much carbohydrates.

In December and January, when the sugar factories are running at full blast, tens of thousands of cattle and sheep from the ranges of Wyoming, Colorado, Utah, New Mexico, and adjoining States where ranching is a great industry are shipped into the sugar factory sections and there fattened for market on sugar-beet pulp.

A valuable feature is the recent discovery that the pulp, because of its mushiness, is especially adapted as a feed for old sheep. Old ewes are commonly afflicted with bad teeth, or "broken-down mouths," as sheepmen call it, and find difficulty in eating the tough forage grasses of the plains.



Thousands of hungry sheep are shipped to sugar factory sections each year



Carting sugar-beet pulp to the cattle-ranges. It is now recognized as a fine fattener for cattle, and is especially adapted to old sheep

And Great Will Be the Fall Thereof

THROUGH all the years this rock has been precariously poised on a hase the greatest dimension of which is twenty-six inches. Excellent work on the part of its center of gravity is responsible for keeping it there. Perhaps some day said center of gravity will make a misstep and the rock will go tumbling down the hillside.

Until then curious tourists will continue to climb hundreds of feet in order to see it. Appropriately situated in the "Garden of the Gods," it overlooks the Platte Canyon.

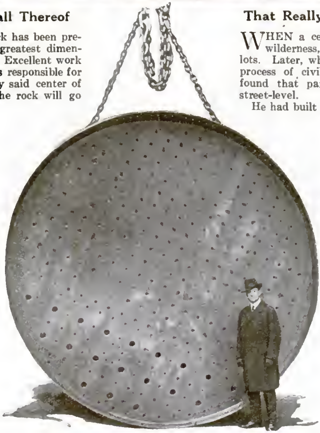
This gigantic rock of red granite weighs about fifty-seven tons. If you doubt its immensity, look carefully at the lower right-hand corner of the rock, and you will see a very small lady and a dog—small when compared with the rock under which they rest. It were well to be far away when this giant starts rolling.

Here's a Non-Raisable Pocket Check-Book

BECAUSE of the unfortunate check-raising hahit among certain ungrateful receivers of checks, an effective machine was invented in which checks for $5 were punched with a "Do not pay over $5" sign, and so on.

A check-protector of this kind is undoubtedly very valuahle, but it is too heavy to he carried around. How can a check he protected without this machine? Very easily.

A patent check that covers amounts up to three hundred dollars is contained in a patent check-book cover of soft leather. By holding the end of the cover ahove the amount for which the check is drawn, the check can be torn straight across.



A Boiler of Tremendous Size

RATHER a large hoiler-head is this. It is more than twice the height of the man standing heside it.

The actual diameter of this enormous ohject is thirteen feet, and a single plate 1 3/16 inches thick was used in its construction.

A number of these hoiler-heads are being made at Portland, Me., for the East Coast Fisheries Company for use on their large trawlers. It is the type that is being used on the *Sea Bird*, the *Pelican*, the *Crane* and other hig steam trawlers.

This particular boiler-head is said to he the largest ever constructed from a single plate in this country. It was necessary to use a specially designed car for the purpose of transporting it to its destination.

That Really Economical Rustic Touch

WHEN a certain New Jersey town was still a wilderness, a trusting man bought one of its lots. Later, when streets were cut through in the process of civilizing the town, the trusting one found that part of his lot was far below the street-level.

He had built his house on a high spot, and therefore a small valley existed between the house and the street. To fill this in would have heen very expensive, and to build steps leading down from the street to a path below, very ugly. So, instead, the economical artistic owner huilt a charming cheap hridge across the gap.

Both bridge and house are pretty, though not at all suited to each other. The house is an up-to-date cement affair with a husinesslike chimney in front. The hridge is an old-fashioned rustic one and would be much more at home in the woods.

A Pipe of Parts for the Chronic Smoker

THE drihhling of infancy has its revival in the adult pipe-smoker. He may be shocked at the idea, but the condition of a smoker's pipe after a few healthy smokes proves it. From the pipe-stem oozes a disgusting liquid—half nicotine, half saliva.

People who ohject to the resulting messy pipe-cleaning process, take courage! Here is a pipe that never gets itself into this condition. Its tip is provided with a draft and drain arrangement, so that when the smoker drihbles saliva into it, the drain promptly swallows it.

The lack of moisture keeps the tohacco from drying in the pipe, and the resultant cleanliness eliminates unpleasant odors. This pipe has all the virtues of an ordinary pipe and none of its failings.

Tip Your Hat in Comfort

AFTER you have gallantly tipped your hat to someone, and put it back on your head with a flourish, there are usually two dents where you grabbed it. Sheepishly you take it off again, punch it out, and reshape it.

Two Englishmen of the name of Jones were so un comfortable because of this propensity of soft hats that they invented a hat-shape retainer.

Two wings of thin sheet-metal shaped to the contour of the front of the hat are attached to a central spring hinge. The whole is fastened to the front of the inside of the hat. You grab your hat where the metal is—it gives to the touch. But when you put your hat back on your head and let go, the wings snap back in place.

© Kadel & Herbert

The Largest Anchor on the Largest Ship

THE *Vaterland,* rechristened the *Leviathan,* is one of the few large undertakings of Germany that turned out successfully. It is so large and moves so swiftly that it carried enough American soldiers abroad to finish up the war. This must have been bitter news for the Kaiser and his U-boat captains.

Large ships need large anchors, and the *Leviathan* has surely got one, as the illustration shows. The man who is painting the side of the vessel looks as if he belonged in "Gulliver's Travels" when we compare him with the anchor. But the trouble is with the anchor: it is so much larger than the anchors we know.

It is undoubtedly an excellent anchor, but it has had very little chance to prove its worth to America, for the *Leviathan* has been so busy in the past year or two that she has had no time to rest.

Animal, Mineral, or Vegetable?

THIS one-eyed monster is another world mystery. It must have existed or the photograph could not have been taken, but no one knows just what it is. The roughness of its surface and its peculiar conformation suggest that it may be a stone. But the United States Geological Survey, which knows all about stones, doesn't seem to think so, and refers us to botanists, suggesting that it may be an oak puffball. Now, we should much prefer to believe that it once lived on earth.

One can plainly see an eye, a nose, and a mouth, so perhaps it is a petrified animal of yore. If the eye were in the center we might claim that it is the mummified head of the giant Cyclops, who lived in Sicily centuries ago.

Everything Is Reversed on This Locomotive Giant of the West

SOME of the big locomotives of the West are completely reversed, so far as their parts are concerned. The engineer's cab is at the front and the boiler behind it. The illustration makes the arrangement clear.

The fuel for this engine is oil, and hence the engineer is one of those happy men who do not get cinders in their eyes when traveling. He leads a jolly life amid his levers and automatic devices for controlling the train.

Although the locomotive is one of the largest of what is known as the Mallet type, yet the operation is less arduous than in the case of a smaller engine. The reason for this is the fact that many of the control levers, which in the smaller types have to be shifted by hand, are operated by steam in the Mallet.

These mammoth locomotives are used on the Southern Pacific Railway on the route over the Sierra Nevada Mountains in California, where the grades are steep and immense tractive power is required. Like huge puffing, panting giants, these great machines rush up the long mountainous slopes, hauling the heavy trains as if they were mere toys.

To take the curves readily, the locomotives are jointed or articulated in such a way that there is a certain amount of bending movement. This is made necessary in very long engines, even though there is the usual pivoting upon the trucks. The radius of the sharpest curve on a railroad has to be known before the design of such locomotives can proceed very far, and the exact amount of every bend in the Southern Pacific lines was taken fully into account in the present instance.

In a railroad accident, a freight engine demonstrated the strength of concrete by crossing and not cracking it

This Pavement Refused to Break

AN example of the remarkable strength of concrete paving was shown in a dramatic manner by a wreck that occurred at Provo, Utah, early in October of last year. The Salt Lake & Utah Railroad and the Denver & Rio Grande cross at right angles at Provo. At the time of the wreck the Salt Lake interurban train was speeding past a rapidly approaching heavy freight on the Denver & Rio Grande. The heavy freight engine struck the front platform of the rear coach on the other road, derailing both trains.

The 65-ton freight locomotive, with the 28-ton coach on its pilot, described an arc of a circle for a distance of about forty feet across the concrete. The freight engine had brakes set and wheels sliding, and the wheel flanges scored the cement for the entire distance. The paving was not broken through, nor even cracked at a single point. The cement is seven inches thick, but it is not reinforced, while the sub-base at the place where the accident occurred is close to an old river channel and is the poorest in the city.

In clearing the wreck, a locomotive was coupled to the rear of the freight and the freight engine was hauled back across the path it had taken when derailed. Notwithstanding this double test of the strength of materials, the concrete remained practically as it was before.

He Turned His Skates into Tanks

© Kadel & Herbert

EVEN skates can be made into very good tanks. That is what was done by the youngster whose product is shown in connection with this article.

Ordinary roller skates and a few pieces of tin were the materials. The side pieces reach to within a quarter of an inch of the ground, and almost disguise the fact that the rollers of the skates are the real rollers of the twin tanks.

There is very much more amusement derived from the use of tanks than could possibly be obtained from just plain roller skates. Anyone who has watched the performance of the two types will admit that this is true. Chiefly there is the fact that the tanks make the other boys envious.

This device, so far as we are aware, has not been patented. Some day youngsters like this young inventor will be taking out patents on their inventions. The engineering education of such boys is only just beginning.

© Kadel & Herbert

A boy with a few bits of tin can transform a pair of roller-skates into tanks

How Uncle Sam Aimed His Artillery

THE great guns which the United States made and used so effectively during the war were aimed by special methods gradually developed by experience. Greater ranges were developed during the present war than were ever attempted in previous wars; and, as the target is frequently hidden from the gunners, various systems of observing and signaling the results of firing were tried by representatives of the various governments.

The United States used the dirigible balloon to good purpose, in connection with signals made with canvas by the gunners on the ground. Observers on the ground near the enemy informed the war balloons by signal where the shells struck, and the gunners were then directed to change the elevation, correct the horizontal angle, or fire as before. The gunners used their canvas markers in replying to balloon signals.

© International Film Service

These men are using strips of white cloth in replying to signals from a United States observation balloon

A balloon observer must be well trained, and an expert in both aviation and artillery. He must understand the making of military maps also, and the more artistic he is the better. Many excellent men were developed from among the vast number who applied for training in this highly interesting service.

Uncle Sam's artillery service was second to none, and the men in it showed remarkable aptitude in taking up new problems and solving them in a satisfactory manner.

Hurling a Man to the Moon

How could a lunar Columbus break the grip of gravitation and reach the nearest heavenly body? What kind of motor would he use? How much power would it take?

By Waldemar Kaempffert and A. J. Lorraine

THERE in the heavens shines the moon—240,000 miles away. How can I bridge that awful chasm? Others have asked that question of themselves before me. Most of them have been novelists or scientific romancers. I am not a novelist, but an engineer, and it is as an engineer that I ask myself the question.

Two hundred and forty thousand miles! The distance alone seems hopeless. And yet, the distance that I must traverse gives me little concern. If I could take an express train I could easily reach the moon in six months. If I could use a fast airplane, a 120-mile-an-hour fighting-machine, it would be a matter of only three months before I beheld at close range the scarred and pitted surface of the moon.

The Distance Is Not the Important Thing

Two hundred and forty thousand miles are nothing. The captain of the fastest transatlantic steamer covers as many miles once every three years; the conductor of a speedy railway train in even less time.

No, it is not distance that perplexes me, but a barrier more formidable than all the ice and snow, all the gnawing cold that guards the approach to the earth's poles. What is it—this barrier? Nothing—absolutely nothing. I am not trying to dismiss it by calling it nothing; for when I refer to "nothing" I mean the utter void of interstellar space. To be sure, the physicists say that the space between the stars is occupied by the "ether." That does not make the void any less a void for my practical engineering purpose.

You will understand my predicament better if you consider the means that we employ to move ourselves about mechanically on the earth. Every transporting vehicle that we use reacts in some way on its environment. The locomotive grips rails by friction. The balloon is buoyed up by the surrounding atmosphere. I find that the greatest height ever attained by a man in a balloon is 35,420 feet. Beyond a certain height a gas-bag will not rise; there is not enough air.

It can no more leave the atmosphere and float about in empty space than a fish can leave the water and sail in the air.

I am trying merely to make the point that, just as the locomotive needs rails or an automobile a road, so a balloon needs air. Between the stars there is no air—only that baffling void. The airplane serves me no better than a balloon. It, too, reacts upon its environment. What keeps it up? Pressure beneath its wings—air-pressure. Hence, like the balloon, it can go so high, and no higher. I find that the altitude record for an airplane is 30,500 feet, made recently by an American aviator, Captain Lang. Without air a plane cannot fly. I repeat: there is no air between the stars.

Suppose it were possible for you to stand between two stars. The side that you presented to the sun would be exposed to his blaze, while the dark side would be frozen

It is clear that all the propulsive engines that man uses to transport himself from place to place on the earth are useless for my purpose. Like man himself, they are earth-bound. I must cast about for radically different means of locomotion—some mechanism that is independent of any reaction on its environment.

There in the heavens shines the moon—two hundred and forty thousand miles away. How can I bridge that awful chasm?

Jules Verne once wrote a novel, "From the Earth to the Moon," in which he tried to reason with something like scientific sobriety that a gun might propel a man to the moon. He literally shot his hero through 240,000 miles of space. Will a huge gun answer my purpose?

Is There Any Limitation to Gravity?

In the first place, I must consider gravity. It ties us to the earth as if by an elastic band. Throw a stone up into the air, or fire a shell from an anti-aircraft gun. The stone or the shell rises to a certain point, and then it falls back as if it were pulled down by a stretched spring.

Now, an elastic band or a stretched spring has its limitations. If we strain it beyond a certain point it snaps. Is there anything corresponding in the case of gravity? I know that the analogy must not be pressed too closely. But this is true: If I could shoot a projectile from a gun with a greater and greater velocity, a point would ultimately be reached when, instead of returning to the earth, the projectile would continue to travel on an independent course through space.

A Shot Fired from the North Pole

I am dealing now with measurable forces. Huge guns have been built, and their muzzle velocities are known. Suppose I were to mount a gun at the North Pole and fire my shot at a sufficient altitude to clear all obstacles. What muzzle velocity would I have to attain so that if I were shot out, safely encased in a projectile, I would never fall back to the earth?

The calculation is simple enough. What is the result? Twenty-six thousand feet per second would have to be the speed of the projectile in which I am housed when it leaves the gun. I would keep on traveling in a circle around the globe. Indeed, I would become a satellite of the earth—a living moon.

The Projectile Would Become a Satellite

If I could illuminate the projectile in which I sit, you would see me rising every one and a half hours at the horizon; you would see me traveling across the sky in about forty-five minutes, and setting at the opposite point of the horizon. I would be a busy little moon; for I would rise and set as many as eight times in a twelve-hour night.

But I do not want to travel perpetually around the earth. I want to reach the moon. Hence my muzzle velocity must be greater than 26,000 feet per second. If it is somewhat greater, my path, as I sit in my projectile, would at first be drawn out into an oblong, or ellipse. Still, at regular intervals, I would always return to my starting-point.

I find that I must increase my velocity to about 37,000 feet (seven miles) a second if I am to leave the earth in my projectile for good and all and to travel forever farther and farther away from it. It is as if the elastic band were torn: gravity no longer confines me and my projectile to an orbit around the earth.

Thirty-seven thousand feet a second! It is stupendous. Can I attain it? Let us see what has actually been done by some of our big modern guns. What are some of the records? Our fourteen-inch naval guns, which in the great world war were mounted upon railway trucks and leveled at the German army, fired shells with a speed of 2,800 feet a second. A six-inch wire-wound experimental gun tested at Sandy Hook attained a muzzle velocity of 3,850 feet a second. It had but a short life. No doubt the highest muzzle velocity ever attained was that of the 75-mile gun with which the Germans bombarded Paris. Artillery officers have estimated that the initial velocity of its shell must have been from 5,000 to 5,500 feet a second—only one seventh of that required to hurl me to the moon. That German gun represents the limit of our present technical resources, so far as gun-making is concerned.

But not yet will I abandon the idea of reaching the moon by shooting myself from the earth. If one gun carries seventy-five miles, how far will two guns carry? I am not trying to joke; this is no facetious application of the rule of three. I find in the patent records of the United States and other countries more than one such method of thus multiplying the power of guns in order to increase the range.

Over and over again inventors have suggested that it may be possible to fire a gun within a gun. Such is the timing arrangement that when the projectile—that is to say, the inner gun—has reached a certain point; it in turn is fired, and the shell projected from it proceeds with a new velocity to its destination. If two guns, one within the other, should prove practicable, why not three, five, eight, or a dozen?

This is precisely what a French army officer, writing in the *Revue du Ciel*, proposes (not very seriously, it is true) as the expedient to be adopted in an imaginary war between the earth and the moon. He assumes an initial velocity of 12,300 feet a second, which, he thinks, is within the limits of possibility in the future. His projectile consists of twelve shells, one within the other—and the final bullet.

Will guns within guns transport me to the moon? How big must the projectiles—the guns—be? How much powder must I use? I make the calculation. What is this? In order finally to land a paltry 16-pound shot on the moon, no less than eight tons of projectile must be fired! There is no need to calculate the explosive necessary.

A Ray of Hope in the Sky-Rocket

I see that guns within guns will avail me nothing. Moreover, only the last shot, that hopelessly inadequate 16-pound piece of steel, would reach the moon. The rest of the eight tons would come tumbling back to earth with a terrific velocity. Look out for your head!

It is very evident that I cannot reach the moon by the gun route. And, even if it were possible, I would be crushed to a pulp by the terrific impact at the moment of departure.

But I am not yet discouraged. A distinguished French aeronautical engineer, Robert Esnault-Pelterie, suggests that I use a sky-rocket. What is it that makes a sky-rocket leave the earth? It is not its reaction upon the air, as many suppose, but rather the recoil from its discharge. A machine-gun mounted on a small railway flat-car would be able to kick itself backward, away from its target, by firing a steady stream of bullets. A sky-rocket might kick itself to the moon.

Some years ago, Rodman Law, the venturesome brother of the famous woman flyer Ruth Law, actually tried to fly with a sky-rocket of huge proportions. His was a successful failure. He did not get very far, but he lived to tell the tale.

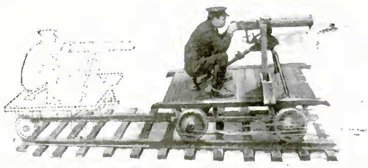
Round Trip to the Moon in One Hundred Hours

In a gun the explosive force is applied very suddenly; the blast lasts scarcely 1-100 part of a second, and it deals a crushing blow to the projectile. Esnault-Pelterie calculates that in a sky-rocket big enough to reach the moon the motive force is applied for about twenty-five minutes. In that time an elevation of about 3,600 miles is reached. After that the car travels on by its own momentum without further application of power. This second stage of the journey occupies something over forty-eight hours. If the sky-rocket principle is practical at all, I ought to be able to reach the moon and to come back again in one hundred hours.

How much power does it take? This time I do not have to make the calculation myself. Esnault-Pelterie has already done that. And what does he tell me? No less than 414,000 horsepower are required! This is allowing a weight of about one ton for the car and its contents. The work of carrying me away from the earth's attraction by means of a sky-rocket figures out as nearly 7,000 calories for each pound lifted.

That is quite beyond the possibilities of any known explosive—dynamite, nitroglycerine, or T.N.T. The most terrific compounds used in the great war are not terrific enough to propel even their own weight over the 240,000 miles that must be covered to reach the moon, not to mention my weight, the weight of my food, and the weight of all the machinery in my car.

But there is one substance that does contain sufficient energy for my purpose, and that is radium. Locked up within a few pounds of it is all the energy that I need.



A machine-gun mounted on a small railway flat-car would be able to kick itself backward, away from its target, by firing a steady stream of bullets. So a sky-rocket might kick itself to the moon

What Happens When Gravitation Ceases to Act?

"What would be the effect upon me if gravity were removed, and removed it would be at a point some thousands of miles away from the moon? . . .

"This is certain: as I approach the moon I will have the sensation of falling headlong through space—a terrifying sensation, which it might be impossible to counteract by the force of the will. . . . In the absence of hand-rails or straps, I should very likely sooner or later find myself sprawling in mid-air, unable to move my body from place to place in the car"

But how can I release it at the rate that I demand? It stubbornly refuses to give out even one half of its energy in less than 2,200 years! If I could hasten the process! Man has harnessed steam, electricity, waterfalls. Can he *unharness* the energy of radium? Some day he will, perhaps, and then a bold man may go sky-rocketing to the moon.

I can picture to myself some of the excitement of that journey, and some of the strange technical problems that must be solved. Being an earthly creature, I must breathe air. Since there is no air between the earth and the moon, with the exception of what little we find in our own atmosphere, I must carry my air with me in the form of compressed oxygen. That will be the least of my difficulties; oxygen-tanks are now an indispensable part of every submarine's equipment.

It will be far more difficult to cope with the cold. Brave explorers have frozen to death in the Arctic and Antarctic wilderness. But the cold that they suffered is as nothing compared with the cold that I must endure. Where there is nothing there can be no temperature. But for practical purposes it is safe to say that the temperature of interstellar space must be several hundred degrees below zero.

But that is not all. Heat, too, must be overcome—the heat of the sun. It seems paradoxical thus to mention intense cold and intense heat in the same breath. But heat, in this case, manifests itself when the radiant energy of the sun strikes its target. Suppose it were possible for you to stand between two stars. The side that you present to the sun would be exposed to his blaze, the dark side frozen. To maintain a suitable temperature, you will have to provide covers on the shady side to keep in the heat, and absorbing surfaces on the sunny side to absorb all you can. Esnault-Pelterie believes that this object can be attained by providing the car with a proper arrangement of light-absorbing (black) surfaces turned toward the sun and light-reflecting surfaces (mirrors) turned away from the sun.

I seat myself in the sky-rocket car.

How Does It Feel When Gravitation is Removed?

Like every other living organism, man has adapted himself to his environment. Remove me from my environment, and I perish. Without air I cannot breathe. Can I do without gravity? What would be the effect upon me if gravity were removed—and removed it would be at a point a few thousand miles away from the moon?

I cannot walk, or stoop, or write, or lift even so much as an eyelid without being influenced by gravitation. I weigh 150 pounds, which means that gravitation is pulling me down by that amount. Can I safely endure the removal of a force which every moment of my life ceaselessly acts

Rodman Law actually tried to fly with a sky-rocket of huge proportions

upon me, and to which I have become so accustomed that I no longer heed it?

For aught I know, the organs of my body—my lungs, my heart—are mysteriously dependent on gravitation. It is certain that they would have developed differently if I were not the plaything of that ever-present force. If gravitation were to cease to act, would this not play havoc with my system? This is certain: As I approach the moon I will have the sensation of falling headlong through space—a terrifying sensation, which it might be impossible to counteract by the force of the will.

Rodman Law's attempt to go up in a sky-rocket was a successful failure. He did not go very far, but he lived to tell the tale

In any case, the ordinary methods of moving about would forsake me. Walking would be impossible. Were the car provided with suitable straps and hand-rails, I could use these to pull myself from place to place. In the absence of such aids, I should be strangely helpless. I should very likely sooner or later find myself sprawling in mid-air, unable to move my body from place to place in the car, having nothing to hold on to, and no gravitation to draw me back to the floor. It is true that if there is air in the car I might propel myself backward by blowing with my mouth, or forward by actually swimming in the air by moving my hands and feet.

Tables, chairs, instruments, tools which were not fastened down would be jumbled in chaotic fashion. The wrench with which I tighten a nut, if I release my grip, would not fall, but hang uncannily in space. It might perhaps be necessary to arrange things so that I should at least have the sensation that gravitation was still acting. This could be done by regulating the speed of the projectile, but only at the expense of much power.

After All, I Belong on the Earth

Lastly, there is the difficulty of stopping this sky-rocket, which has been hurled from the earth with a velocity of over seven miles. Brakes of some kind must be applied. Esnault-Pelterie calculates that in the last four minutes of the journey to the moon the motor must be reversed.

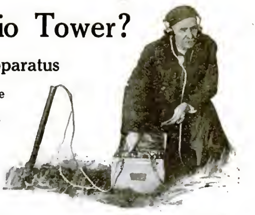
And, when I reach the moon, dare I leave the car and walk about on that airless, dead body—that planetary cinder? Even with a tank of oxygen strapped to my back and with a breathing-mask on my face, I might court death. The moon is cold—bitter cold—cold with the coldness of interplanetary space. May I leave my heated car and brave a temperature low enough to freeze the lightest gas? And the blinding, fiercely glowing sun—I must brave that too; for a man on the moon is exactly in the predicament of a man poised in interplanetary space. There the sun hangs in the sky, a sky not like ours, white and blue, but a terrible sky, jet-black even at midday, a sky pricked even at high noon with the stars that we on the earth see only at night.

I am walking in a land of dazzling high-lights and black shadows. It seems like some impossible nightmare.

One minute on the moon would be so harrowing an experience that I would surely rush back to my car, pull the starting lever of my radium engine, and hurl myself back to earth, where I belong.

Will This Do Away with the Radio Tower?

Arguments for and against a new wireless apparatus



A portable outfit for receiving and sending wireless messages by an underground route

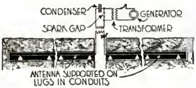
THAT it is possible to do away with expensive concrete and steel wireless towers is believed by the supporters of a recently announced radio system patented by Messrs. James Rogers and Henry Lyons of Hyattsville, Md.

Instead of suspending a number of parallel wires at a distance above the ground, one wire is stretched in a ditch a few feet below the earth's surface, another wire being laid in a second conduit in the opposite direction.

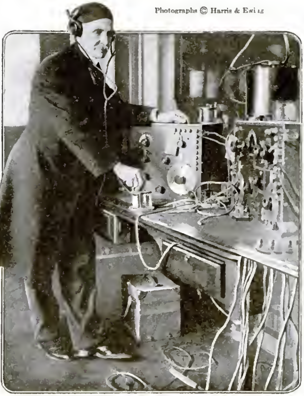
There are said to be several advantages besides the obvious one of decreased expense. An interesting electrical effect is made manifest in the system's tendency to direct the messages transmitted in a direction at right angles to the buried wires. Evidently it is necessary only to lay pairs of wires in different directions around the compass, and it will be possible to use just that pair which will send the message in the direction desired. This action, it is claimed, will lessen the interference caused with the present-day aerials when one message comes in right after another, which continually happens in receiving stations, no matter whether both messages are meant for that station or not.

Still another result claimed for the Rogers-Lyon system is its comparative freedom from static disturbances, another bane of the radio operator.

The antenna of the new system being underground and in a different plane from the suspended aerial, the effect of lightning is said to be, at most only a click in the receivers.



Photographs © Harris & Ewing



The inventor, James Harris Rogers, and the wireless apparatus in his house, by which he has received messages from Paris, Rome, and Berlin

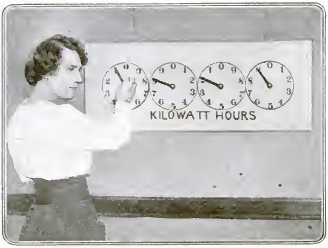
These for the advantages. The disadvantages voiced by the "opposition" are, first, that the sending and receiving distances are cut down, making it necessary to employ more powerful sending outfit and more sensitive receiving equipments. They also point out that, while electric lightning storms may not affect the underground wireless so much, one would only be exchanging one source of trouble for another, since stray earth currents caused by electric storms will now be heard more strongly than ever in the instruments. Again, the ordinary aerial can be made to direct its messages as well as this one.

Whether we can omit the wireless tower, therefore, seems dubious.

Teaching Women to Read the Meter

METER reading is one of the war-born jobs for women that are likely to survive the war, and many of the electric lighting companies have started schools to train girls to read the dials. The capable-looking young person in our picture is manipulating the meter dials before a class in one of these schools. The figures are arranged clockwise on some of the dials and anti-clockwise on the others, an arrangement that calls for close observation to prevent mistakes.

Probably the average reader would say that the indicator on the left is pointing to 1, and yet it is not sufficiently near to the figure 2 to read 18. As the second indicator is pointing to 8, we conclude that the first figure is 0. The complete reading is 819 kilowatt-hours.



This young woman is learning to read the meter dials in the school-room of a large electric company

The girl students are given a three days' course in meter readings of this character, and then start to work as professional readers, accompanied by an expert until the theories learned in the school can be applied accurately in practice. Learning a profession in three days seems like pretty rapid progress; and yet, the students become very proficient.

The instructor of the school discourses quite largely upon the hardships of the work; and when he is through with his talk quite a number of the pupils become quitters. The examination weeds out some more, but those that are left stick to their jobs just as tenaciously as do the men.

When an Airplane Perches on the Roof

It's a sign that the day when all of us will fly is not far off

The machine leaped over a huge sign and landed on the top of the building

Jules Vedrines hunts eagles and canvasses election districts in his airplane

PARIS is familiar enough with the roar of airplane engines. But the roar that it heard soon after midday on January 19 last was so much louder than anything that it had ever heard before, so obviously in the midst of the city, that it rushed from its cafés and its houses and looked up at the sky.

Then it understood why this particular roar was different from anything to which it had been accustomed by German air raids.

A biplane was skimming the chimneys. Never had a machine flown so low over the city. Surely, thought Paris, the pilot must be in peril. No sane man would dare to take such chances.

Then a wonderful thing happened. The machine literally leaped over a huge advertising sign, just as a horse would jump over a fence, and landed on the roof of the building behind one of the largest department-stores in Paris.

In a minute the streets around the store were thronged. Out of a side door emerged Vedrines, one of the most daring airmen France has produced, a man given to spectacular performances in the air, a man who has shot eagles from his flying-machine in the Pyrenees, a man who actually canvassed an election district in an airplane when he tried to become a member of the French Chamber of Deputies.

And what was the meaning of all this? Simply to advertise in a characteristically sensational way a proposed trip by air around the world.

Vedrines' achievement, very properly, attracted international attention. For the first time in the history of flying, a man succeeded in landing on a city roof — a space thirty yards by twelve, in this particular case. To be sure, an American pilot, years ago, landed on a smaller platform built over the deck of one of our warships. But the feat of Vedrines was even more hazardous.

The atmosphere, if you could but see it, is a turbulent, heaving, billowing fluid. It is full of whirlpools, eddies, currents, and counter-currents. It dashes against a row of houses, a forest, a mountain, as the surf dashes up against a seaside cliff. Over Paris the air must be tossed hither and thither like the water in a whirlpool.

These, then, were the aerial conditions that Vedrines had to combat. It required not only courage but extraordinary skill to brave such atmospheric perils. To land as Vedrines did, with practically no injury, speaks volumes for his adroitness—all the more so when it is considered that his was an antiquated Caudron biplane, a pre-war model, driven by an 80-horsepower rotary Rhone engine.

Vedrines, we have said, wanted to attract attention to himself as a possible aerial circumnavigator of the globe. He did more than that, wittingly or unwittingly. He symbolized the pilot of the future.

The day is not far distant when every large city will have its landing platform on the roofs of specially designed buildings. From the suburbs of New York, Paris, and London business men will fly to and from their offices quite as regularly as they are now whisked back and forth by train.

For the first time in the history of aeronautics, a man had succeeded in landing on a city roof

A Kerosene Torch that Thaws Coal and Welds Metals

It has been found a very useful tool in cold weather

YOU know what difficulty is experienced in transporting and distributing coal in a cold climate. For days at a time a car may lie idle before the coal will thaw sufficiently to admit of removal. Traffic is blocked and railroad losses are incurred.

All this explains why a special kerosene torch has been invented. It gives a flame eighteen inches long and four inches in diameter at its widest point. Moreover, a temperature is maintained that averages about 1,800 F., and this is accomplished with practically no attention. Ten gallons of kerosene in this improved torch will maintain the correct temperature for fully half a day.

Frozen loads of coal, formerly left to the mercy of the weather, are easily thawed by this kerosene torch

The big car in the picture contained frozen pea-coal that could not be removed. After an hour's application of the torch, the chutes beneath were opened and the coal dropped into the bins.

The torch is a welder, too. It brings the fire to the job, instead of taking the job to the fire or forge. The flame is of the non-carbonizing kind, which is an important qualification.

The blast is secured from air pumped into the tank by a powerful hand pump with check valves for regulation. Every tank is equipped with strong handles, so that it can be carried by one man.

Specially designed nozzles guard against clogging and the consequent reduction of flame and heating effect. One pumping will store and compress sufficient air to last from three to five hours. Hose for the device is made from a special oil-resisting material, and is very flexible.

Folding Circus Tents with a Clothes-Wringer

Personally, we don't believe any improvement on the circus necessary

IF you ever rose before sunrise to see the circus come to town, you cannot have forgotten the marvelous organization that made a new tent city spring up before your eyes. This organization was so perfected that, when Buffalo Bill's Wild West Show was touring Germany, the army authorities detailed a group of officers to the show to study the methods of making and breaking camp.

Wonderful as was that old organization, it has been improved, one of the latest of the new circus labor-savers being a mechanical tent-folder. The new apparatus is fashioned much like a clothes-wringer, and is made up of a giant spool on which the tent canvas is wound by power from an independent gasoline engine mounted on the wagon carrying the spool.

Unrolling the "big top" is an easy job with this apparatus

A system of rollers operated by turn-screws in the floor of a wagon is utilized to roll the canvas on the spool uniformly and to press out any water that may be in it.

The mechanism of the apparatus is simple in principle, consisting of a long hollow steel tube placed longitudinally of the wagon body and mounted in suitable bearings inside of which are fixed metal disks to serve as spool-like ends to prevent the canvas rolling up unevenly. The spool-shaft is revolved by an independent gas-engine driving through a roller chain and a train of gears. The driving chain gear on the gasoline engine shaft is provided with a clutch and a handle manipulated from the ground, so that the winding operation can be started and stopped whenever desired. Each section of the tent canvas can be rolled up in about thirty seconds' time.

The apparatus is the design of William H. Curtis, of Denver, Col.

On this giant spool the tent canvas is wound by power from a small engine

If the tent is wet, a wringer squeezes out the water as the canvas is rolled up

Finding Your Way Among the April Stars

Identifying four of the stars with the aid of the Dipper—the great star map

By Ernest A. Hodgson, *of the Dominion Astronomical Observatory*

As we look out along the plane of the universe we see the great band of stars of the Galaxy, or Milky Way. If we look at right angles to that direction we see but few stars. We are then looking toward the "Galactic Pole." The evening sky of April brings the Galactic Pole above us and bends the denser band of stars about our western horizon.

The Dipper Is Our Sign-Post

It is now possible to verify some of the directions indicated by the Big Dipper. Arcturus can now be seen pointed out by the backward sweep of the handle. It is on the meridian at about 8 P. M. in the middle of the month, and at that same time the directions to Capella, Castor and Pollux, Regulus, and the Pole-Star may all be verified, as all will then be visible at once. We may now add to our list of directions given by the Dipper three more, making the list complete.

If we trace northward through the center of the bowl (just as we traced southward to find Regulus), and proceed for an arc of about seventy degrees, we shall come to the bright star Deneb, of the constellation Cygnus, the swan. In January Deneb was disappearing in the northwestern sky. In April it is appearing in the northeastern sky.

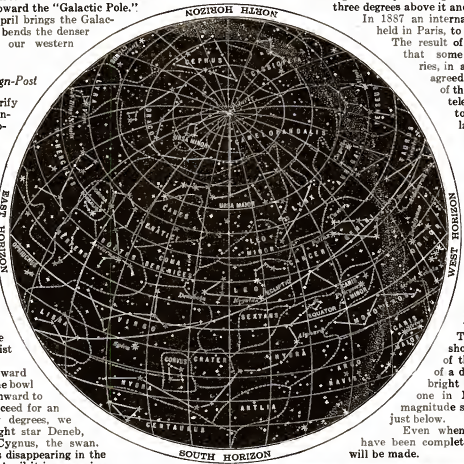
Let us suppose the Big Dipper has a second handle *above* the first and radiating out from the same point. If we trace across the sky for a distance about three times as great as the true handle and a little more tipped up with respect to the bowl, we shall come to a very bright star, Vega, in Lyra. The handle, continued through Vega, would, in 30 degrees more, meet a second bright star, Altair. Altair is in the constellation Aquila, and may be distinguished by its bright companion star about three degrees above it and nearer to Vega.

In 1887 an international conference was held in Paris, to make a great star map. The result of that conference was that some eighteen observatories, in all parts of the world, agreed to take each a section of the sky and, using similar telescopes and cameras, to photograph on a large scale the entire heavens. Some 22,154 plates were planned to a little more than cover the sky, since each plate was to have a slight overlap. Only now are the plates beginning to appear in print.

A Sample of the Chart

The charts show a section of the sky two degrees each way. The reproduction below shows a section of one of these plates, two thirds of a degree each way. The bright star in the middle is one in Monoceros. A fifth-magnitude star is shown by a dot just below.

Even when these photographs have been completed, only a beginning will be made.



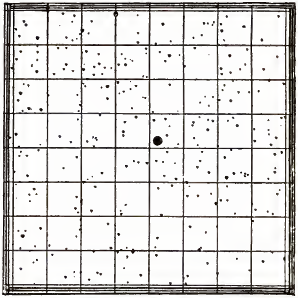
April Star Map

The map above represents the appearance of the sky at the times listed below. It is specifically arranged for the latitude of New York, 40° N., but is practicable for ten degrees on either side of this latitude.

March	5,	midnight
"	13,	11:30 P. M
"	21,	11 "
"	29,	10:30 "
April	7,	10 "
"	15,	9:30 "
"	23,	9 "
May	1,	8:30 "
"	9,	8 "
"	16,	7:30 "
"	24,	7 "
June	1,	6:30 "
"	8,	6 "

The magnitudes are indicated on the map by stars of various kinds as follows: 0, open center; 1, eight points; 2, six points; 3, five points; 4, four points; 5 is indicated by a single point. All time in Eastern Standard (not summer)

The Dipper is used as a many-rayed pointer. Nine of the most prominent stars of the heavens can be found by following imaginary lines between the different Dipper stars. Deneb, Vega, and Altair are three of them, and they have just arrived in the spring sky



On the scale of the circular map this section of the sky is almost covered by a dot used to locate one single star. But this plate was photographed telescopically, and there are 387 stars on it

How to Find the April Planets

OUR planet map this month has one new feature. The times are set to the "mean Sun." Our true Sun progresses at such a varying rate that clocks could not be made to follow it. Accordingly we start off an imaginary Sun at a given time, in conjunction with the true Sun. This "fictitious" or "mean" Sun proceeds about the *equator* at a constant pace, so as to complete the year and again meet the true Sun.

The latter is sometimes ahead of and sometimes behind the mean Sun. The maximum difference is somewhat less than 16½ minutes, and may require to be added to or be taken away from the time as given by observations on the Sun itself. Time, as given on a sun-dial, is sun time, and would need to be corrected to get mean time. The times given by our map from now on will be mean time, since we shall refer the disk to the positions of the mean Sun. The mean Sun and the true Sun are in conjunction on April 15.

At the beginning of the month Mercury is to the east of the Sun and sets after it—an evening star. It is so close, however, as to be lost in the sunset. It is still retrograding, having begun this backward movement on March 29. It passes the Sun on April 7, inferior conjunction, since the planet is *between* us and the Sun. On April 20 Mercury ceases to retrograde and moves eastward again. It moves so much more slowly than the Sun, however, that it lags farther and farther behind, rising before the Sun—a morning star.

Venus is still east of the Sun, setting some two hours after it. Its distance from the Sun constantly increases during the month.

Mars, though an evening star throughout the month, is lagging nearer and nearer to the Sun, and sets so soon after it that it cannot be seen for the setting Sun.

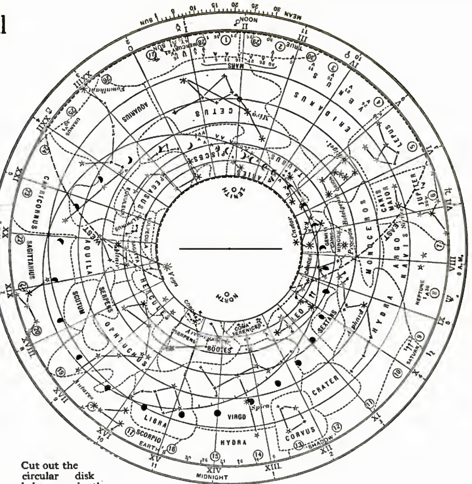
Jupiter is still in the constellation of Gemini. This constellation is now getting so low in the evening sky that Jupiter sets within a few hours after the Sun.

Saturn continues to retrograde very, very slowly until April 23 when it becomes stationary and then travels eastward again.

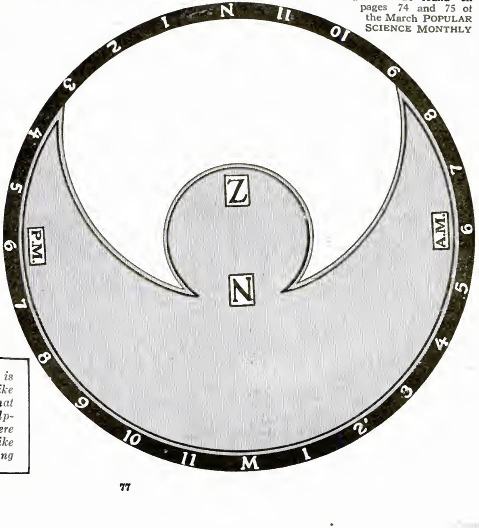
Uranus and Neptune are indicated on the map, but are invisible except with a telescope. At the end of April all the planets have ceased to retrograde, for the first time this year.

There will be a conjunction of Saturn and the Moon on April 9; of Mercury and the Moon on April 28; and of Mars and the Moon on April 30; Mars does not reach conjunction with the Sun until the 9th of May. The Moon moves so much more rapidly than Mars that, after they have *their* conjunction, she catches up to the Sun in the same day, while Mars requires ten days to accomplish this.

The POPULAR SCIENCE MONTHLY *is publishing every month an article like this by Mr. Hodgson. If you feel that these articles can be made more helpful, write to the editor. And if there are any questions that you would like to ask about stars, send them along*



Cut out the circular disk below, and then run a pin through the center of both the disk and the map above. To see the section of sky visible at any time on any date, turn the disk until the required hour (on the disk) is opposite the date (on the map). Further directions and an illustration of the map in use will be found on pages 74 and 75 of the March POPULAR SCIENCE MONTHLY



Things that Add to Household and Office Comfort

And now, as you finish washing your hands, your foot touches a lever and warm air quickly dries them, doing away with the old unsanitary towel

Having but one leg, constructed in such a manner as to produce absolute stability, this ironing-board may be attached to any closet or to a window-sill

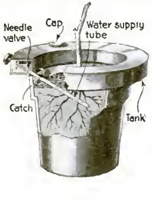
The last word in writing-desks is the built-in type. It comes in a variety of styles. If desired, it can be so disguised as to appear like a part of the wall panel

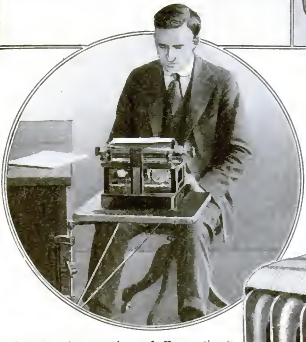
Unlike the usual moth-bag, this portable folding wardrobe is odorless. It is closed down one side by a patent inter-locking device. It may be folded up small and packed in a suitcase

Something new is a soap tablet that upon being punctured permits liquid soap to ooze out, thus adding greater cleansing qualities than those of ordinary soap

Push a button and, *presto*, this cigarette case splits in half, allowing easy access to the cigarettes. It is unusually thin and will easily fit into the vest pocket

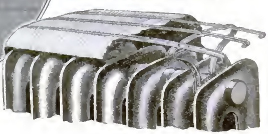
Plants will not require constant attention if this device is attached to the flower-pot. It drops water directly at the roots of the plant, insuring an even distribution without overflowing





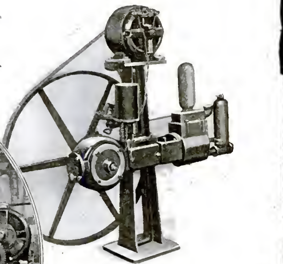
Adding to the convenience of office routine is the swinging office stand, which fastens to the corner of the desk and holds a typewriter, etc.

To prevent the accumulation of dirt in inaccessible corners of the radiator, this crepe-paper cover is supported on endwise adjustable frames to fit any size radiator

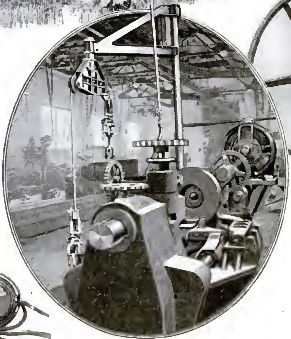


Machines that Lighten Work and Shorten Hours

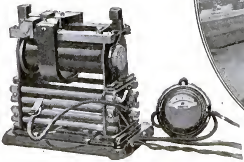
Using its rear wheel to steer itself, this self-propelled threshing-machine gets its power from a 40-horse-power kerosene engine



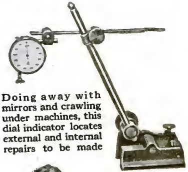
The self-controller on this noiseless automatic electric pump starts and stops by water-pressure



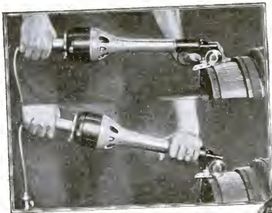
This new machine has an electric drive chuck equipped with a balanced hoist



A simple fool-proof magnetic rectifier that charges storage-batteries from alternating current. Its weight is not more than nineteen pounds

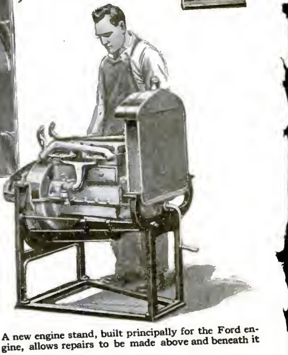


Doing away with mirrors and crawling under machines, this dial indicator locates external and internal repairs to be made

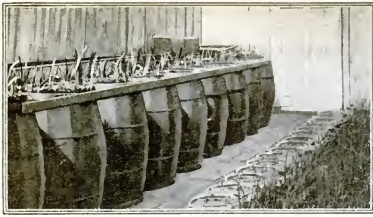


A power-driven machine designed for under-cutting commutators without their removal from operating positions or disturbing the brush-holder rigging

Adjustment of the big guns "over there" was made by a small powerful truck moved by one man, getting the gun quickly into position for firing



A new engine stand, built principally for the Ford engine, allows repairs to be made above and beneath it



A complete rotation of crops may be raised in the useful ash-container by adding a little top soil

Cattle will not break through even a light fence if a barbed wire is extended in front as shown here

Farming in an Ash-Barrel

THE snap-shot above shows a row of barrels acquired in the congested section of a large city. The scheme for a garden proved a decided success. Two thirds of the space within the barrels was filled with ashes and on top of this was placed about a foot of soil. A regular rotation of crops was then carried out, and by the time the season was over the seed had brought forth fruit, some sixty and some a hundred fold.

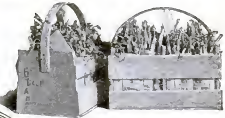
There is no reason why the city resident of average intelligence should not become an expert in gardening, and incidentally add to the nation's vegetable supply.

It Keeps the Cows Out

AMONG every six or twelve cows there seems to be always one that jumps and breaks fences and leads the other cows astray. The first thought that comes to one who is considering the matter is that a fence should be made so strong that no cattle can break it and so high that none can jump over it. But this plan is expensive.

One of the most promising methods is to protect the fence with a barbed wire just in front of it. The wire may be fixed to an arm attached to the fence. One ingenious inventor has made such a device so that the arm can be swung over to either side of the fence.

"Udo"—It Looks Like Celery-Asparagus



A crate of udo that was shipped from Antioch, Cal., to Washington, D.C.

FROM far-away Japan comes this new vegetable with the odd name of udo. Some of it has been grown in California and shipped to Washington and other cities, where it has received indorsement and commendation.

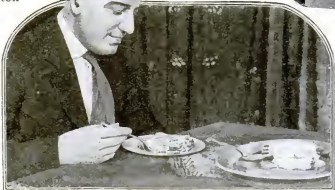
This latest contribution to the table bears some resemblance to both celery and asparagus; but, unlike them, it is easily grown, readily blanched, and requires little care. A patch of it can be forced every spring for at least six years, and probably much longer.

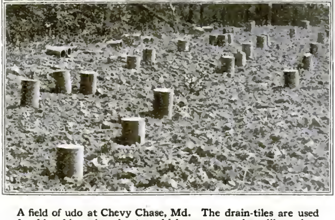
When eaten raw, the plant is a disappointment, producing reminiscences of resin and the long-leaf pine. When boiled in three waters, however, supplemented by an hour's plunge in ice water, the resin is removed and the plant becomes edible. It can be served in soup, as a salad, or with cream sauce on toast.

A good recipe for preparing the food is as follows: Peel the shoots and drop them into cold water; cut into 4-inch lengths; boil in salt water for ten minutes, then change the water, adding a fresh quantity of salt, and boil until the product is quite soft. Prepare a white sauce, such as is used for cauliflower or asparagus; place the udo in the sauce and allow to simmer; after which serve on toast in the usual way.

The food value is about the same as that of celery or asparagus. Asparagus-growers in California were the first to experiment with udo as a commercial enterprise in this country. Anyone with a greenhouse or cold-frame facilities should have no difficulty in raising the plant from fresh seed, which is sown a quarter of an inch deep during the months of March and April.

He seems to be enjoying his udo





A field of udo at Chevy Chase, Md. The drain-tiles are used for blanching the shoots, which are somewhat like celery

Who'll Be the First to Fly Across?

Here is one of the candidates for fame and fortune who pins his faith on a seaplane

As we go to press there are more candidates for the honor of making the first transatlantic flight than there used to be for a position of judge at a beauty contest.

The interesting entry in this greatest of air sweepstakes that we present here is notable for its comparatively modest dimensions. The *Sunrise*, as Captain Hugo Sunstedt christened his seaplane, has an upper wing spread of 100 feet and a lower of 71 feet. Some of the giant flying-boats sport wings of more than 125 feet from tip to tip.

Sunstedt's Airplane Different

But the wings of the *Sunrise* have been designed to give as much lifting power as possible without cutting down the speed below eighty miles an hour, flying with a full load. This is less by at least ten miles an hour than the speed of a Handley-Page flying under similar load conditions; but there is nearly always, a twenty-mile air current from west to east on the ocean air lanes and Captain Sunstedt figures that eighty miles an hour and 750 gallons of gasoline will see him through.

Built to face whatever weather the transatlantic air lanes may hand out, the *Sunrise* has been given extra strength in all parts subject to strain.

The pontoons, weighing 400 pounds each, with highly developed stream-line design, are thirty-two feet long and are built of the wonderful Balsa wood, lightest of materials, covered with linen. They are divided into eight water-tight compartments each, and carry emergency food-lockers which can be reached from the deck.

When the seaplane *Sunrise* soars along the air lanes on the transatlantic route, her pilots and crew will live in this comfortable cabin

© International Film Service

There is little that is novel in the design of the fuselage, if we except the fitting up of the forward end after the style of the inclosed automobile, thus making a comfortable cabin for four persons. On the dashboard in front of the pilot's seat are dials which record the number of revolutions turned up by each engine, the speed of the machine, and its altitude. There are also radiator thermometers, oil-pressure gages, shut-off valves, ignition switches, and clocks within easy reach or sight of the pilot. Two six-cylinder Liberty engines will drive the *Sunrise*.

© International Film Service

Not the biggest of seaplanes, yet the distance between upper and lower wings is considerable. Lieutenant Paul Micella, standing on the lower wing, is reaching as high as he can

At eighty miles an hour, Captain Sunstedt estimates that he can fly from New York to Newfoundland, and from Newfoundland over the short route to Ireland, without stopping on either leg to replenish his fuel. The over-water distance in an air line from Newfoundland to Ireland is 1,860 miles.

To the man who first makes the flight will fall riches as well as fame. More than $125,000 in prizes have already been offered, and more than half are without restriction.

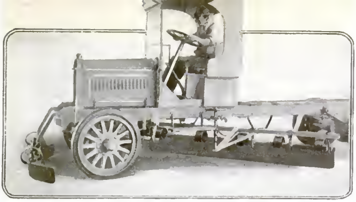
"The Time Has Come"

The greatest handicap is the lack of knowledge concerning the air roads. What kind of weather prevails at various altitudes? What is the direction and force of the air currents?

But men like Captain Sunstedt brush aside all such suggestions. "The time has come to make a trial," they say. "We will succeed."

© International Film Service

The *Sunrise* as she appeared before launching. She has a wing span of 100 feet and she is equipped with Liberty motors



This road-scraper is equally effective in handling clay, sand, gravel, or snow, either wet or packed

This Useful Implement Builds Roads and Removes Snow

THE road-scraper shown above can be used for building roads or for removing snow from city or country highways. In advance of the front wheels are two small scrapers designed to secure good traction for the truck. Like the large scraper in the center, these small ones are spring-suspended. The large scraper is twelve feet long and is set to clear a path seven feet in width. Once set, the machine requires little or no attention.

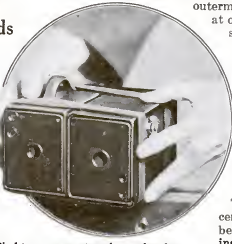
Interurban truck service is growing by leaps and bounds; and road commissioners everywhere are studying the local conditions and providing road machinery that will keep the public highways in a high state of efficiency.

A New Outdoor Sport—Making Stereoscopic Pictures

MAKING stereoscopic pictures can be accomplished quite successfully by placing two cameras side by side and snapping them simultaneously.

Cameras taking a $2\frac{1}{4}$ by $3\frac{1}{4}$ picture do very well for the purpose. The lenses, having been ground by machinery, are similar, as are the other parts. In fact, all inexpensive fixed-focus cameras of the same make are produced from standard parts and are therefore practically identical.

Having selected two cameras that meet the requirements, tie them together, placing one of them upside-down so that the snap levers are outermost. By pressing both levers at once the exposures will be the same and identical pictures will result. In the finished stereograph the left-hand picture is from the film that was in the right-hand camera, and to avoid mistakes the films should be marked accordingly.



Bind two cameras together and make your own stereoscopic photographs

A piece of pasteboard may be placed between the two cameras to prevent the backs from binding when opening for reloading. The distance between the centers of the lenses will then be about $3\frac{1}{8}$ inches. In mounting, this same distance can be adhered to.

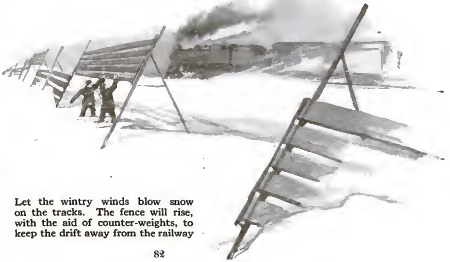
Here's the Blizzard Fence—a Railway Protector

DRIFTING snow is the railway's most formidable danger. The remedy, according to Herman J. Schwitzer of Braham, Minn., lies in the proper fencing. He claims that the fence must be increased in height as the drift increases in the vicinity of a cut; otherwise the snow will ultimately topple over into the cut.

A foot added to the height of the drift must be met by a similar increase in the height of the fence. But how can a carpenter work in a blizzard? Schwitzer constructs a fence that increases its height automatically. It grows with the drift, under the fury of the storm and the vibration of passing trains.

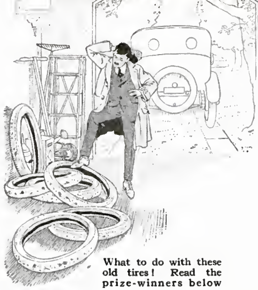
The growing fence starts low and meets its antagonist on the level; a sliding section gradually rises to the occasion. Counter-weights make such a feat less difficult, and Schwitzer has adopted this means.

Possibly some other means than the passing train could be devised for raising the sections. The inventor makes use of hand levers at times, but that necessitates the presence of attendants. Various means for automatic control suggest themselves. For example, the counterbalance might have a shelf on which the snow would accumulate, and as the weight of this snow increase it would overbalance the movable section and elevate it. This would have the advantage of depending upon the storm itself and not upon a passing train.



Let the wintry winds blow snow on the tracks. The fence will rise, with the aid of counter-weights, to keep the drift away from the railway

What to do with your Old Tires—*By Our Readers*



What to do with these old tires! Read the prize-winners below

The most useful thing in the world is an old automobile tire. Our contest has proved it. We were nearly swamped by answers, and we have decided that if a man were cast away on a desert island with a cargo of old tires he could make Robinson Crusoe look like a piker. Here are the three prize-winning answers—all we have room for now; but in the June number of Popular Science Monthly *we will show in a two-page picture display some of the remarkable, not to say startling, uses that have been found for discarded automobile tires.*

Part of an inner tube, including the valve, made this air-chamber for a brazing torch

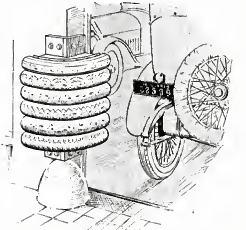
First Prize

Bumpers for the Sides of a Garage Door

By Clifford A. Butterworth

OLD automobile tires can be effectively used, as the illustration proves, as bumpers for the sides of a garage door, to prevent the one person in fifty who misjudges the width of the door when turning in from seriously damaging either his car or the door-casing.

The tires are first cut into four sections, after which they are nailed to pieces of 2-in. plank cut to the shape shown. Six of these sections are then fastened with lag screws to other pieces of plank. The bumpers are mounted so that the lower section will be about a foot higher than the sill.



Save up your discarded tires until you have six, and make a buffer for the garage door

Second Prize

An Air-Container for a Brazing Torch

By Morris G. Miller

A FINE air-chamber for a small brazing or soldering torch can be made from a good portion of a used inner tube, including the valve.

Cut the ends square, and make two clamps from four pieces of wood as shown. Before sealing the ends, insert the air connection in any suitable place. The air connection consists of a piece of 1/4-in. brass tube, threaded for nuts at one end. Two hard rubber washers are used on the tube under the nuts to clamp it in the tire.

These washers are made from ordinary faucet rubbers by enlarging the hole. It is best to dish the inner face of the washers a trifle with a sharp knife. Apply rubber cement around the hole and on the washers, letting it dry for a few minutes before screwing down the nuts.

The clamps are 2 in. longer than the width of the tube when flattened out, and a 1/4-in. bolt is passed through holes in each end. First clean the inside of the tube near the end with gasoline, and apply the cement. Let it dry to become tacky; then close up, bend over, and insert between the clamps.

If much soldering or brazing is done, a good plan is to place a shelf at the back of the bench, as shown, to support the tire. Connect a hand- or foot-pump to the valve, and a rubber tube from the air connection to the air inlet of the torch. After filling the container with air, it will require only a few strokes of the pump at short intervals to keep up the pressure sufficiently to the desired point.

Third Prize

An Efficient Lawn-Sprinkler Made from an Old Tire

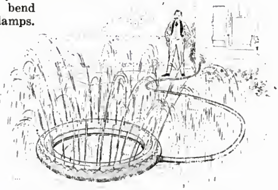
By John Sebesi

SELECTING a worn tire that could not be of further use on an automobile, one car-owner made use of it for a lawn-sprinkler. The clincher part of the tire was stitched together, then vulcanized to make it quite water-tight at that part of the tire. The tire was then placed flat on a bench, and holes were punched through on one side.

Near the center of the tread a hole was made, and a nipple inserted with the necessary waste nuts to hold it in place. This furnished the connection from the garden hose to the water faucet.

This sprinkler being much larger in diameter than the ordinary sprinkler, much more ground is covered in a more efficient manner.

This is a novelty with the additional feature of being original. No reader of Popular Science Monthly who owns an automobile can now conscientiously neglect his lawn during dog-days.



It makes a much more effective sprinkler than the kind you pay good money for

The victory of prosperity---the Victory Loan

How to Build a Rob-Roy Canoe

By Stillman Taylor

In contrasting this type of canoe with the type described, the advantages of the Rob Roy are easily seen. The open canoe is not adapted to rough water, as is the Rob Roy. A few days' practice will enable the amateur to handle the Rob Roy as the expert swimmer handles his body in the water

THE Rob-Roy canoe is a decked craft especially designed for the canoeist who travels alone, and who prefers a double-bladed paddle. It is an old and well known model, and cruises of hundreds of miles have been made in this kind of craft.

The canoe described, while of inexpensive and easy construction, light in weight, and drawing but little water, is not a flimsy makeshift, but a strong and serviceable canoe; particularly well suited for river and lake use. The full deck gives less room than the regulation open canoe, but the covering makes a tight and dry boat.

When properly constructed, the hull should weigh less than 38 pounds, and will accommodate the average man and a reasonable amount of camp baggage and provisions needed on a cruise of two or three weeks. Cost of construction will vary, but should not exceed ten or twelve dollars. Only the most ordinary tools are required. They consist of a cross-cut and rip saw, chisel, screw driver, draw-knife, plane, gimlet or wood drills, hammer, rule, and two or three cheap wood or metal clamps.

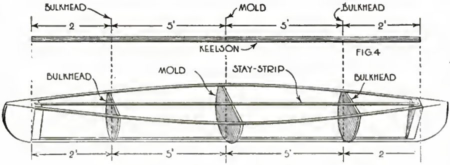


FIG. 5

How to fasten the gunwales in place, countersinking the brass screws flush in the wood

Specifications and List of Material

1 piece spruce, 14 ft. by 1 inch square—keelson.

2 pieces oak, 7 in. by 7 in. by 3 in.—stems.

2 pieces spruce, 14 ft. by 1 in. by ½ in—gunwales.

13 pieces spruce, 14 ft. by 1 in. by ⅛ in.—ribbands or battens.

3 pieces 10-ft. oak strips, 1 in. wide by 3/16 in. thick—cut up for ribs.

2 pieces spruce, 5 ft. by 1 in. square—ridge-beams.

2 pieces spruce, 27 in. by 2½ in. by 1 in.—deck beams.

2 pieces spruce, 37 in. by 1 in. by ½ in.—cockpit deck-braces.

1 piece oak, 8½ ft. by 1 in. by ¼ in.—cut for cockpit frame plates.

4 pieces oak, 4 in. by 4 in. by ¼ in.—cockpit frame knees.

1 piece oak, 8½ ft. by 1 in. by 3/16 in.—cockpit coaming.

2 pieces white pine, 10 in. by 8 in. by ½ in.—fore and aft bulkheads.

3 pieces white pine, 4 ft. by 5 in. by ¼ in.—cockpit flooring.

2 pieces 1-in. half-round moulding, 13 ft. long—fender wales.

1 piece oak, 13 ft. by ½ in. by ¾ in.—outside keel.

9 yards 8-ounce unbleached duck, 40 in. wide—covering hull and deck.

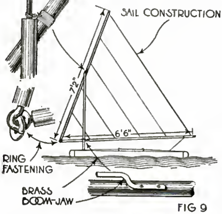


FIG 9

A sail is often of great assistance in running before the wind

Beginning Operations

The required number of pieces may be ripped out to the dimensions with a circular saw at any mill, or the builder can do it himself with a hand ripsaw. The dimensions given are for the finished pieces; therefore they must be exceeded a trifle for finishing up the rough. For the stock, select an A-No. 1 spruce board 14 ft. long, 12 in. wide, and 1 in. thick. Select with equal care a clear and straight-grained board of white oak, 14 ft. long, 12 in. wide, and 1 in. thick. Both boards should be of the finest quality and well seasoned. From the spruce board rip out the needed pieces as given in the specification table, and do likewise with the oak board. Smooth up all material to the dimensions given, and you are ready to begin work.

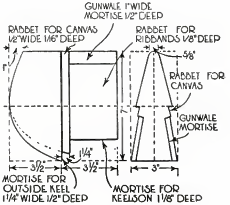
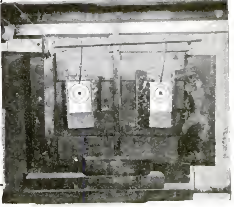


FIG 1

How the two stems are shaped and rounded into a graceful bow curve

RANGE BUILT IN THE CELLAR OF A CHURCH

Close-up view of backstop and pulley system for carrying targets



Making an up-to-date range from a dingy cellar

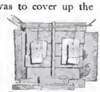
Sharpshooter Medal

"NO PLACE to shoot." That's no excuse for a fellow with any ingenuity. Here is what the Boy Scouts of Troop 18 did in the thickly settled city of Albany. They wanted to form a Local Unit of the National Winchester Junior Rifle Corps. They wanted to learn the fine points of rifle shooting and earn the famous Winchester Marksman, Sharpshooter and Expert Rifleman Medals.

They got busy with their Scout Master and looked around for a place to *build* a range. Finally they hit on a 50 ft. space in the cellar of the church!

Making every shot safe

The first thing to do was to cover up the window and build a safe backstop over it. This was done by using a piece of boiler plate ¼ of an inch thick and 4 ft. by 4 ft., large enough, you see, to stop even the wildest shots of the beginner. Over this were clamped heavy 1⅞ inch boards.



The main backstop, ¼-inch boiler plate, 4 ft. by 4 ft., covered by 2-inch thick boarding

Now this backstop of 1⅞ reinforced by ¼ inch boiler plate, will hold any stray shot from a .22. But shot after shot concentrated on one spot will soon chew your board to shreds. So to take care of the concentrated fire just behind the targets, two extra pieces of ¼ inch boiler plate, 2 ft. square, and covered with soft 2-inch thick boards, were nailed to the backstop about 18 inches apart. 50 ft. from this backstop they built a regular counter 3 ft. high and 2 ft. wide with a carpet cover—just like the kind you see at public shooting galleries. This was the "firing line."

Target set up and lighting system

Targets were carried to the backstop from the firing line in pairs—so that two boys could shoot at the same time—by means of an overhead pulley and wire system.

The gallery was lighted by electric light behind the firing line and the targets were lighted by electric light reflected down from bulbs above the backstop and protected from stray bullets by the beams of the cellar roof.

A neat little club room with benches built into the walls adjoined the gallery, and its spick and span white-painted walls were decorated with handsomely framed pictures of the club's camp life, record targets and Winchester Marksman and Sharpshooter diplomas, won by various members.

Start a W. J. R. C. "Unit" with your friends

The job of finding a place to shoot, rigging up a range and getting your rifles is always easier and cheaper *when you have a bunch of your chums in on it.* There's more fun, too, in the actual shooting when there are other fellows to compete with.

So why not get together with half a dozen of your chums, join the Winchester Junior Rifle Corps and organize a regular Unit or Club which will be officially recognized by National Headquarters. When you have enough Marksmen in your Unit, you will be matched against other Units. Any boy who starts a Unit gets a Special Service Pin.

The W. J. R. C. will help you from start to finish in rigging up your indoor and outdoor range.

The W. J. R. C. gives you all the instruction necessary to become a real expert in the use of a rifle. It provides for officers, supervisors and adult instructors to make your shooting safe.

It costs you nothing to join the W. J. R. C. There are no dues and no military obligations whatsoever.

Denson Reid—Age 11, of Birmingham, Alabama, winner of Marksman and Sharpshooter Medals and high ranking rifleman of the W. J. R. C. for 1918

The W. J. R. C. was organized solely to encourage better marksmanship and better sportsmanship among boys and girls of America. It is intended to develop the qualities of fair play and manliness which are essential to success in after life. Any boy or girl not over 18, who is in good standing in his or her community, is eligible.

Membership in the W.J.R.C. covers the entire United States. There is hardly a town now that has not at least a small "Unit" of the big National Organization where boys are learning to become expert riflemen and are competing among themselves for the famous Winchester Marksman and Sharpshooter Medal. You, too, can earn these trophies of marksmanship if you join the W. J. R. C. and start shooting now.

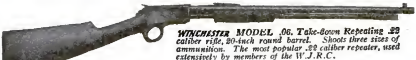
Get the official plan and handbook

Write today for the Winchester Junior Rifle Corps "Plan for organizing a W. J. R. C. Unit," and for the official handbook, "How to handle a rifle safely." This booklet tells you all about the W. J. R. C. and describes in detail the fine points of shooting—alignment of sights, the three correct positions, rules for gun safety, the care of rifles, and the proper rifle for you to use.

If you are a boy scout give your name in full, the troop you belong to, and the name of the Scout Master.

If you are not a boy scout, state what boy organization, if any, you belong to, giving the name of the official in charge.

National Headquarters
Winchester Junior Rifle Corps
275 Winchester Ave., New Haven, Conn.
Division 420



WINCHESTER MODEL 06. Take-down Repeating .22 caliber rifle, 20-inch round barrel. Shoots three sizes of ammunition. The most popular .22 caliber repeater, used extensively by members of the W.J.R.C.

WINCHESTER Take-down .22 caliber single shot rifle. A low priced, light weight gun made in two sizes.

WINCHESTER JUNIOR RIFLE CORPS

National Headquarters, 275 Winchester Avenue, New Haven, Conn., U. S. A.

Winchester Junior Rifle Corps
National Headquarters, 275 Winchester Ave.
New Haven, Conn., U. S. A. Division 420.

Gentlemen:

Please register my name as a member of the Winchester Junior Rifle Corps, and send me a membership button and certificate of membership. Also tell me how to organize a Local Unit of the W. J. R. C.

Very truly yours,

Name...

Street Address..

City.......................... *State*.......................

"I certainly never intend to use an old-fashioned machine again!"

THE same reasons that made the Western Electric Machine preferred for war-relief work make it ideal for home use. It can be carried to the work, since the machine—motor, carrying case and all—is no larger than an ordinary travelling bag. The electrical control of the motor is so delicate that sewing can be done at any desired speed. This is a full-sized machine that does any kind of sewing. Sewing the electric way does not tire the user.

Western Electric
Portable Sewing Machine

Although neatly finished, you will find it convenient to put the machine away in the closet when the work is done. It costs only $39.50 ($41.50 west of the Rockies)—less than most well-known makes of pedal-power machines.

Put it away on the closet shelf

Use it on the porch where breezes blow

If your electric shop or department store cannot show you this new kind of machine, write for Booklet No. 13-AT, "The New Way to Sew," and the name of our agent nearest you.

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Gentlemen:
Please send me Booklet No. 13-AT, describing the Western Electric Portable Sewing Machine.

Name..................................

Address..................................

Each of the two stems is fashioned from an oak block 7 in. wide and 3 in. thick. Study the sketches in Fig. 1 to obtain a clear idea of how to shape them.

One half of the block is rounded to the graceful bow curve. Draw this on paper until just right, then pencil it on the block. The grain in the block should run up and down in order to chisel out the rabbets easily.

Clamp the block in a vise, and with a draw-knife pare to the wedge shape shown—tapering from ⅝ in. in width at the curved stem to 3 in. in width at the keel end, as shown. Mark out the beveled rabbet for the canvas, which is ½ in. wide and 1/16 in. deep. This is beveled, sloping from 1/16 of an inch to nothing where it runs into the outside face of the stem. The mortise for the outside keel is 1¼ in.

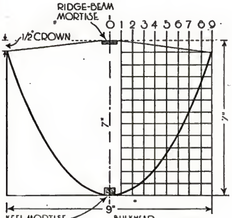

FIG 2

Draw a full-sized pattern on a sheet of wrapping paper to avoid mistakes

wide and ½ in. deep. The mortise for the keelson and bottom ribband is ⅛ in. deep. The mortise for the gunwales is 1 in. wide and ½ in. deep.

The Bulkheads

Two bulkheads are placed on the keelson, one 2 ft. from the forward end, the other 2 ft. from the opposite end. These are made exactly alike and to the dimensions given in Fig. 2. To avoid mistakes, a full-sized paper pattern should be made. Divide the paper into small squares on one side, and the required curve is easily traced in. Cut out to the pencil outline, crease pattern in center, and fold over to trace curve on the other side of it. This will insure both sides being alike. The ridge-beam mortise is cut in the exact center of the top, and the mortise for the keel in the bottom of the bulkheads. The top should be crowned ½ in. as indicated in the drawing, and a notch cut on either side for the gunwales.

The Center Mold

The center mold is made to the dimensions shown in Fig. 3. It is

The BRUNSWICK
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Now Ever-Present

HERE are the secrets of The Brunswick Method of Reproduction. Learn how we gained that wonderfully pure tone which has given The Brunswick Phonograph such prestige.

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Brunswick tone is infinitely better, for tones considered rare a few years ago are ever-present in this super-instrument. No one can remain unappreciative of its fullness, richness and clarity. And all appreciate the banishment of metallic sounds. Once you hear The Brunswick, your own ear will confirm these statements.

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26½ in. wide and 8¾ in. deep; and, as it is only used to give shape to the hull while building it, it may be sawed out of any 1-in. stuff at hand. Make a full-sized paper pattern for this mold, in the same way suggested for the bulkheads. As shown, the bottom on each side of the center dotted line is flat for a distance of 6 in. This gives a craft with a flat floor, an essential feature to give stability in a canoe. As shown in the drawing, the mortise for the keel is cut, as are two notches on each side of the mold at the top to admit the gunwales.

The Keelson

The keelson is merely a straight strip of spruce 14 ft. long and 1 in. square. The bulkheads are located 2 ft. from each end, and the mold placed in the center. This is plainly shown in Fig. 4. From the center measure off equal spaces, and draw a pencil line to mark off the stations where the ribs cross. As each rib is let in or mortised into the keelson, mark out and cut a mortise at each mark, making the notches 1 in. wide and 3/16 in. deep. This will insure each rib fitting flush with the keelson.

Setting Up the Frame

Since the bottom of the canoe is straight, it may be built directly on the floor. The oak strips for the ribs may now be cut up—the longest about 40 in., as may be noted by running a tape-measure around the center mold, and decreasing proportionately in length toward each end of the frame. Put these pieces to soak in a tub of hot water.

At the stations indicated, fasten each bulkhead in position to the keelson, with a flat-head brass screw, turning in the screw from the outside and countersinking the head so that it lies flush with the outside surface. Now screw the stem pieces in place, and fasten a staying-strip on top of the frame running from one stem to the other. Fasten this in the center, nailing it temporarily in place with small finishing nails or brads to the bulkheads and stems. This will keep the frame from spreading out of shape. Now set up the mold in the center, and when plumb fasten in place by a nail through the staying-strip.

The gunwales may now be fastened in place. An easy way to do this is to fasten one end in place in its mortise cut in the stem, then bend into the notch in the bulkhead, and screw solidly in place with flat-head brass screws, countersinking the heads flush. As the mold is to be removed later on, the gunwale is merely temporarily fastened to it with a single screw or nail. Continue by bending the gunwale to fit the notch in the after-bulkhead, fasten this and then the opposite end of the gunwale to the after stem. Put on the other gunwale in the same way. (See Fig. 5.)

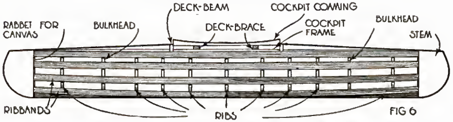

FIG 6

After the center mold is removed the canoe is ready for the deck-beams, which should be screwed into place

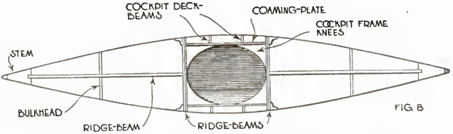

FIG. 8

Eight-ounce cotton duck of 40-inch width will suffice to cover the canoe

How the Ribs Are Placed

The ribs may now be put in, and if not yet pliable enough to bend readily, boiling water poured upon them will soften up the fibers of the wood.

The ribs are fastened to the keelson with 1-in. brass screws. Begin by putting in the two center ribs. Drill a hole in the center of each rib the same size as the wire of screw, insert the rib in its mortise in the keelson, and turn in the screw, countersinking the head slightly so that the screw-head is flush with the rib. Bend the end of the rib to a curve, and clamp or wire it to the outside of the gunwale. Put in the other center rib in the same way, but do not cut off or tack the ends to the gunwales just yet.

The five ribs should now be screwed in place on each side of the hull—to the stems and bulkheads solidly, and temporarily fastened to the mold by a nail partly driven in. This will

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give a solid framework, and the rest of the ribs may be put in without danger of twisting or sagging of the frame. When all the ribs are in, measure the height on both sides to check up the work, then fasten the ribs to the ribbands with $\frac{5}{8}$-in. copper tacks. Drive the tacks from the outside of ribband through the rib, and clinch well on the inside. Copper rivets may be used if desired, and, while this is the best possible construction for all boat work, it takes more labor and is, of course, more expensive.

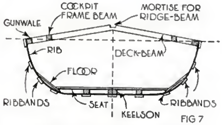
When all the ribs have been fastened to the ribbands, screw the ends to the outside of the gunwales with $\frac{5}{8}$-in. brass screws, and saw off the projecting ends flush with the gunwales. The bottom ribband may now be screwed in place, and the top ribbands which cover the ribs at the topsides should be screwed to the gunwales.

The center mold may now be removed. The complete framework, ready for the canvas, is shown in Fig. 6.

Attaching the Deck-Beams

The two deck-beams that mark the length of the cockpit may next be put in. As shown in Fig. 8, these beams are fashioned with a projecting tongue which fits over the bottom side of the gunwale. A small brass screw is turned in through this tongue, and two brass screws are turned in through the upper half, which butts against the gunwale. This makes a good solid joint, stronger than if the beam were mortised into the gunwale.

As shown in the cross-midship section in Fig. 7, the deck is crowned by making the beams $1\frac{1}{2}$ in. higher in the center. The cockpit frame, consisting of the coaming plate and knees, may now be screwed in place,



The inside of the cockpit knees are sawed out to form the oval shape

and it is a good plan further to strengthen the deck by screwing a white pine knee to the beam and the gunwale, as shown in Fig. 8. While the hull is strong without it, an additional deck-beam may be put in between the cockpit beam and the bulkhead at each end.

The ridge-beam is now put in. This is a spruce strip 5 ft. long and 1 in. square. It extends from the stem to the cockpit beam at each end. A mortise is cut in the stem, and in the top of the bulkhead and deck-beam to receive it, as the top must be quite flush in order to lay the canvas smooth-

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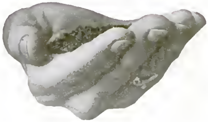

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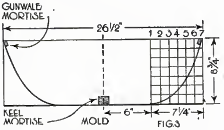
ly over it. Screw the ridge-beam to the stem, bulkhead, and deck-beams with 1½-in. brass screws, countersinking the heads flush with the surface.

The two strips of oak forming the cockpit coaming-plates are now put in. These should be mortised into the top of the deck-beams and screwed solidly in place. The four cockpit frame knees are next screwed to the corners of the coaming-plate and deck-beams. As shown in Fig. 8, the inside of these knees are sawed out to form the oval shape of the cockpit. The short deck-beams that brace the deck on either side of the cockpit are now put in and screwed solidly to the gunwales and to the coaming-plate. Fashion these with a tongue on the lower half, the same as the deck-beams.

The hull is now ready for the canvas; but, before stretching this on, it is a good plan to put in the flooring. This consists of four white pine boards. Screw small ¼-in. blocks on the under surface of each board where it bears against a rib. This will raise the floor sufficiently to let any water run through. The boards should be laid on each side of the keel, and the seat rests upon the end ones, as shown in Fig. 7, being supported by the keelson and a narrow strip running fore and aft and bearing on the ribs.

Covering the Bottom with Canvas

Eight-ounce cotton duck will be found heavy enough for a light canoe of this design, and it is best to put the canvas on in one piece. If the boat is 27 in. beam, canvas of 40-in. width will be wide enough, and the hull will need five yards.

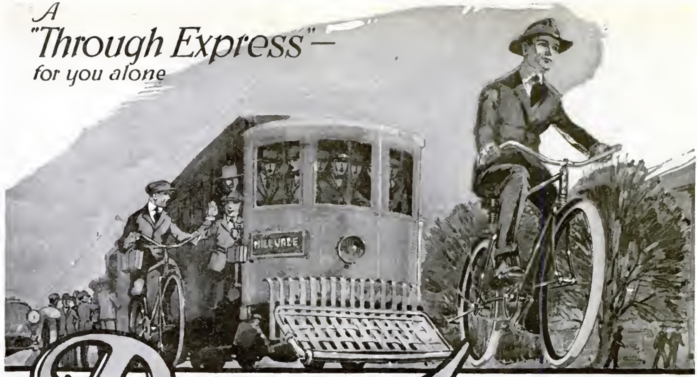


As the center mold is used only to give shape to the hull, it may be made from any 1-in. lumber at hand

Stretch out the piece of canvas on the floor and pencil a mark down the middle of the strip. This will indicate the keel line. Lay the canvas on the bottom of the hull, stretch it as tightly as possible toward each end, and secure by partly driving in a few tacks—preferably copper tacks with flat heads, sold as "three-ounce." These will be about ⅜ in. long.

After tacking the canvas along the keelson from one stem to the other, pull it as tightly as possible to stretch it over the center rib, and tack it on the top of the gunwale. Continue to work toward each stem, stretching the canvas lengthwise as well as crosswise. Space the tacks about 1¼ in. apart on the gunwales and about 2 in.

A "Through Express"— for you alone



Dayton Bicycles

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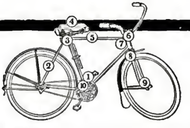

6 Dust-proof head adjusting cone. Extra large High Duty ball bearings. Cones case-hardened in cyanide.

7 Outside joint-bead construction. Eleven inner reinforcements in frame, all dip-brazed.

8 Double anchored fork sides with solid steel spool between plates.

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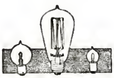

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apart along the keelson, but drive them only part way in. When the canvas is stretched, take up any wrinkles that show, and drive in all the tacks, trimming off the overlap along the gunwales. The tacks along the keelson may now be pulled, since the outside will be screwed on here later on. The canvas at the stems must be folded neatly to fit into the rabbet which has been cut in the stem to receive it. The fold of canvas may be covered up later on.

Stretching the Canvas Deck

Five yards of 40-in. duck will also be needed for the deck covering, and this should be attached in one piece. Draw a pencil mark down the center, and fasten the two ends with a couple of tacks partly driven into the top of the stems. Now stretch the canvas as tightly as possible lengthwise, and fasten with six or eight tacks partly driven in along the center line into the ridge-beam. Working from the center toward one end, stretch the canvas over the gunwales on each side and tack in the center of top rib.

The edge of the canvas should be folded in about ½ in. to prevent the canvas from pulling away from the tacks. Space the tacks about ½ in. apart. The heads of the tacks will be covered up later on when the half-round fender-wale is screwed in place.

To cut out the canvas covering for the cockpit, carefully cut away the cloth at least 4 in. inside the cockpit frame, stretch the canvas tightly, slash the cloth at intervals, and pucker to make the canvas fit the oval cockpit, then tack the edge to the inside of the cockpit frame.

The Cockpit Coaming

To bending the cockpit coaming into place, first give it a thorough scalding to make it pliable. If no steaming facilities are at hand, wrap the board with plenty of cloth and pour boiling water over until it is in condition to bend. If a perfectly oval cockpit is wanted, the coaming must be cut off to the right length to have the ends butt against each other in the center of the sides. However, the coaming may be bent to shape and the ends joined in front in a V-shaped point, if preferred. In cutting the coaming, do not get it too short, but allow at least ¼ in. more than seems necessary, to prevent the joint from spreading apart when the board is screwed solidly into place. Attach with brass screws, countersinking the flat heads quite flush.

While a fairly good finish is gained without it, a piece of small quarter-round molding may be steamed and bent around the coaming along the deck to cover up the paint. First make the joint water-tight by calking with a few strands of candle-wicking, then brush on a little white lead paint.

The two strips of half-round mold-

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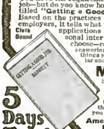

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ing are now screwed to the outside of each gunwale to cover the heads of the tacks, thus making a buffer or fender-wale. The ends of the molding are planed down to a neat taper on the outside where they fasten to the stem piece. These are attached with brass screws, the heads countersunk, and the holes filled with putty, colored to resemble the paint to be put on the canoe; thus assuring an even coating throughout.

The Outside Keel

The oak strip for the outside keel is now attached. This fits into the mortise on top of the bottom ribband and is screwed solidly to the stem pieces with brass screws. In attaching the keel to the keelson, do not drill a hole through the ribs, but turn in the screws between, otherwise the backbone will be unnecessarily weakened.

As to paint, nothing is so satisfactory as a dark green. It is attractive and serviceable, and is especially desirable for the deck, because light colors hurt the eyes by reflecting too much light. Five or six coats of paint will be required to fill the canvas and make a smooth surface. The more paint applied the heavier the craft will be, and if a very light-weight canoe is wanted, simply give it a single coat of paint, and apply more as needed.

The Double-Bladed Paddle

The paddle is made with a ferruled joint, like a fishing-rod. While the paddle can be made, it would be better to buy one, as in this way you can get the paddle best suited to your weight. The 10-ft. length is a good one, and the blades should be oar-shaped, with the ends protected by strips of copper or brass. Spruce makes the best paddle. That the edges may "feather" or cut the air, the blades are turned in the ferrule until they are at right angles with each other. Dip-cups are sometimes used to prevent the water from running down the shaft, but only the novice uses them, since it requires but little paddling experience to acquire the knack of throwing the drip ahead and away from the canoe, as the paddle is rolled in making the stroke.

The Sailing Rig

While a canoe of this light design is not satisfactory for beating against the wind, a sail is often of great assistance when running before the wind, and the lateen rig illustrated in Fig. 9 will be found very handy on a cruise.

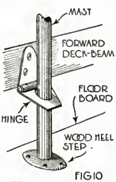

FIG 10
Either screw-eye or hinge may be used

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The long, live spring in the "YANKEE" Quick Return Spiral Ratchet Screw-driver relieves you of much of the work of driving and drawing screws. Saves about half your time too.

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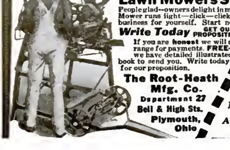

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The short mast is 4 ft. long and about 1¼ in. in diameter. The yard is 7 ft. 6 in. long and about ⅞ in. in diameter. The boom is 6 ft. 10 in. long and the same diameter as the yard. Spruce can be used, but bamboo is the lightest and strongest material. Fishing-poles, known as bamboo cane, can be used for the spars.

A good way to step the mast is shown in Fig. 10. A large strap-hinge is attached to the forward deck-beam, and the lower flap is cut off and bored to fit the mast. The foot of the mast fits into a wooden block screwed to the floor-board. A screw-eye may be used in place of the hinge if desired, but the latter folds up when not in use.

The sail is attached to the mast by means of a ring lashed to the yard, which fits over a pin driven into the top of mast. The yard is attached to the boom by means of connecting rings, made by screwing two screw-eyes in the end of the yard and boom (if bamboo is used, drive a wooden plug in the end to screw the eye in) and connecting the eye with a brass split ring. A strip of half-round brass, bent as shown in the drawing, is screwed to the boom and forms a jaw which holds it to the mast.

How to Repair Your Canoe

Repairs are easily made, in canvas craft, by coating a patch of silk or muslin with shellac varnish. The shellac made by dissolving orange shellac in alcohol should be about as thick as molasses, and may be smeared on with a flat stick. A special marine or canoe glue is also put up for making repairs, and every canoeist should keep this shellac on hand. The water will soften the shellac in time; but if a coat of paint is brushed on after the patch is thoroughly dry, it will last for years. When there is plenty of time for making repairs, coat the patch with spar varnish, and paint on another coat over the patch after sticking it down.

A Simple Box for Holding Spark-Plugs

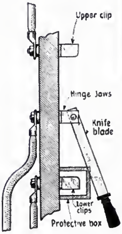
A DEEP cigar-box, of the size in which fifty cigars are packed, makes a good foundation for a box in which to keep automobile spark-plugs. It may serve to carry extra plugs in the car, or to protect all of the plugs of an engine while the car is being overhauled.

The first step is to tear off the cover, and make a sliding top out of it by cutting grooves near the top of three edges of the box. Then get a block of wood that fits snugly inside of the box, after which bore six or more holes of a diameter slightly larger than the thickest part of the plug.

Smaller holes can then be drilled in the bottom of the first ones to take the bottoms of the plugs.—JOS. BRINKER.

It Prevents the Accidental Closing of a Switch

THE accompanying illustration shows a simple arrangement for preventing the accidental closing of a vertically mounted knife switch. It consists of a small box, made either of wood or fiber, preferably assembled without the use of nails or screws, so proportioned that it will fit over and inclose the lower clips of the double-throw switch.



The box is held in position by the weight of the switch blade

When it is desired to keep the switch open, the box is placed over the lower clips and the switch blades are pressed down against it, thus preventing its displacement.—PETER J. M. CLUTE.

A Dirt-Guard for Use in Overhead Boring

A SIMPLE and inexpensive guard to protect the eyes of the man drilling, and to keep dirt from falling upon machinery beneath, is shown in the accompanying sketch.

A funnel of suitable size made of cardboard—or even newspaper may be used—is shaped over the drill so as to divert grit and chips into it. When the work is finished, the guard is easily slipped off and placed aside for future use.—ERNEST SCHWARTZ.

A cardboard funnel on a drill used for overhead boring keeps chips from falling

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A Merry-Go-Round Driven by the Wind

You can make it yourself

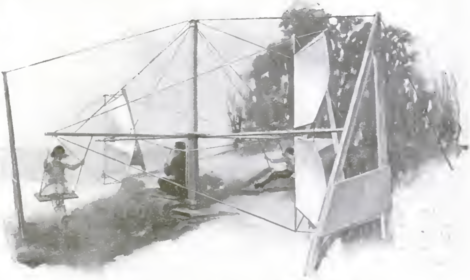
THE illustration shows a wind-driven merry-go-around designed for use at the shore or mountainside where there is a breeze almost daily. There are swings for two persons, and a seat for the operator at the center within reach of a cord which controls the machine's motions.

10 ft. of canvas 4 ft. wide.

200 ft. of No. 12- to 15-gage wire.

Rope, heavy twine, nails, casters, and pipe.

The design is such that it can be readily changed to meet the desires of the builder or conform to the materials on hand. For this reason, few definite dimensions have been given.



A contrivance that offers the double advantages of being easy and inexpensive to build and a sure-hit amusement for the children

A 15-ft. mast, held upright by three guy-wires, revolves upon a small stump or flat block. Four arms radiate from the mast, supporting sails and swings. The sail control is shown in Fig. 1. Pulling the cord down exposes the same amount of canvas on each arm to the wind, and stops the machine. The weight of the merry-go-around is carried on six or eight casters set in the mast end, as shown in Fig. 2. A method of cutting the sails is shown in Fig. 3; Fig. 4 shows the top bearing, and Fig. 5 the guy-wire anchors. The materials needed are as follows:

One 15-ft. mast.

Four pieces for arms 8 ft. by 6 in. by 1 in.

Four 4-ft. sail-masts.

Four 4-ft. booms.

Several shorter lengths.

This type of a wind merry-go-around has been evolved from a study of a number of tests made with a horizontal or sailing windmill. In the experimental windmill various shapes, sizes, positions, and materials for sails were studied. It was found that increasing the number of sail arms does not proportionally increase the power. This is due to blanketing, or the passing of one sail before another, thus momentarily cutting off the wind. With four sail arms the wind is turned from a sail twice in each revolution, making a total of eight eclipses to a revolution. With six arms there are eighteen eclipses, and with eight arms (the number used in many Chinese mills) there are forty. A sail unit of two sails is more powerful than one large sail.

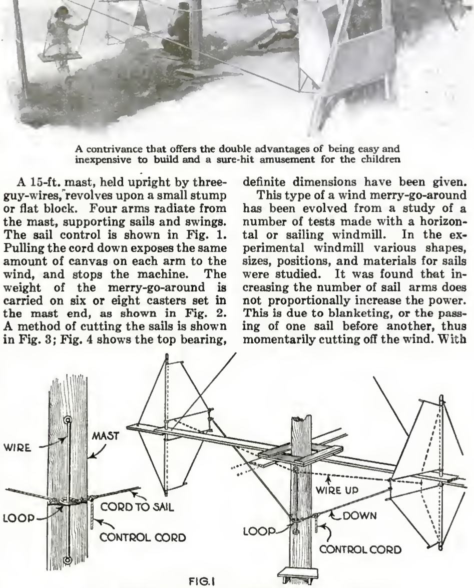
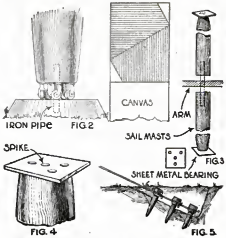


FIG. I

The sail control and how it operates to start and stop the machine, which can be made to brake either slowly or quickly



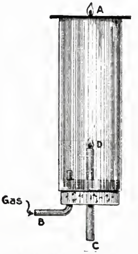
The stays should have some form of adjustment, as they will frequently need tightening

Again, in one revolution the boom of each sail is flung over to take the wind. In winds of thirty miles an hour or more not only a great wind pressure on the sail but an increasing centrifugal force whips the boom over, tearing it loose or snapping it in two, unless, of course, the mill is shut down or some compensating device is employed to prevent it.

Further, canvas sails, bellying a trifle before the wind, but stretched tight to prevent flapping, give one hundred per cent. more power.

Burning Air in an Atmosphere of Illuminating Gas

BURNING a jet of air in an atmosphere of illuminating gas can be easily accomplished in the following manner: Insert in the bottom of a lamp-chimney a two-holed stopper carrying glass tubes, as shown in the diagram, tube *CD* being about ¼ in. in diameter. On top of the chimney, place a piece of asbestos paper with a hole in the center. Place the palm of the hand over the top of the chimney, and turn on the gas.



Illustrating how one flame will burn over the other

The air is quickly expelled from the chimney, and the gas may be lighted at *C*. Now remove the hand from the top of the chimney, and the burning jet will rise to the position *D* and continue to burn. The gas may now be lighted at *A*, and the air drawn in at *C* will burn at *D* surrounded by an atmosphere of illuminating gas.—FLOYD L. DARROW.

Quick Relief!

When you see red, and your teeth come together with a click, and you could break a chair or something—don't do it! Grab your pipe, jam it full of good tobacco and light it *right away*. A few minutes later you'll be glad you did so.

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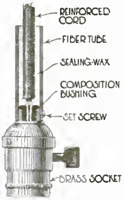
Protecting Drop Cords Over Machinery

WHERE drop cords to electric lights are installed over machines that use a constant flow of oil the re-inforced cord near the socket is subjected to constant handling by the operator with oily hands. This causes rapid deterioration of the insulation, bad appearance, and eventually trouble at this point. The following method of overcoming this evil is cheap and easy and quite satisfactory. It also acts as a strain relief for the cord terminals.



Safety first for drop cords

Referring to the illustration, which shows the construction clearly, it will be seen that the device consists of a fiber tube about 4 in. long with an inside diameter of 5/8 in., which is sufficient to cover the threaded collar of the socket. This tube has a hole drilled near one end to slip a round-head machine screw, that is turned into the hole, in the socket collar provided for the bushing set-screw, thus fastening the tube firmly to the socket cap. After it is in place sealing wax is poured in.

Poultry Nests on the Spokes of a Wheel

A NOVEL place for hen's nests is shown in the illustration. An old carriage wheel was mounted on its axle and the axle set vertically in the ground. Between each two spokes is a space convenient for a nest. To hold the nest, mesh wire was hung between, slightly slack so that it would bag. Into this was placed straw or hay for the nest.—J. A. MONTGOMERY.

An apartment-house for hens which can be revolved to obtain the eggs without moving from one position

This Is a Handy and Versatile Tool

DENTISTS use a machine called a dental engine when drilling teeth. The shaft is flexible, and the dentist bends it this way or that, to suit his convenience. When the drilling is finished he removes the drill and puts on a sandpaper or emery disk, or even a small circular saw. What a handy thing this would be for the work-bench—but the price of one of these machines is considerable. However, at slight cost, one may be made and is wonderfully convenient.

A brass or steel coil spring is procured about two feet long and about as big around as a lead pencil, shown at *A*, Figs. 2 and 3. To one end of this coil a short, rigid shaft, *G*, Fig. 2, is fitted, the coil coming up over the shaft and close against the collar, *F*. The coil and shaft are then soldered to each other so that they turn together. The same is done with another short shaft on the other end of the coil, *A* and *O*, Fig. 3. This makes a complete flexible shaft with a short, rigid shaft at each end.

FIG.1

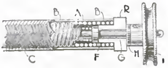


FIG.2

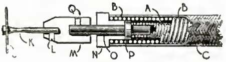


FIG.3

Diagrams of flexible shaft and connections of dentist's drill

Another coil spring, somewhat larger, about one inch longer, and of bigger wire is used as a sleeve. Into one end of this is fitted a bushing *R*, Fig. 2. The sleeve *B* is brought up close to the shoulder of the bushing and soldered to it.

A rubber tube or cover, *C*, Fig. 2, is slipped over the whole thing, coming up against the shoulder of the bushing. After this is done the other bushing, *N*, Fig. 3, is put in place, that end of the sleeve soldered to it, and the rubber tube pulled up to the shoulder of that bushing. A washer, *H*, and pulley, *I*, Fig. 2, is put in place. On the other end a check, *M*, is fastened to shaft *O* by a set screw *Q*. A mandril, *K*, with a sandpaper disk, *J*, is held in the chuck *M* by a set screw, *L*. This completes the tool.

The machine may be fastened to a work-bench, and run by foot-power or by a motor, as shown in Fig. 1. Sandpaper disks, emery disks, carborundum wheels, mandrels, etc., can be easily supplied.

Teaching a Bottle How to Smoke

AN amusing experiment or trick can be performed as follows: Take an ordinary wine- bottle and drill a small hole in the cork by heating

This gives a very clear idea of how the trick should be done

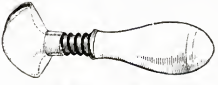
a 10d nail red-hot and pushing it through the center of the cork while in the bottle; then enlarge the hole for about ½ in. of its length to the diameter of a cigarette. Take the cork out, and fill the bottle with hot water, allowing time enough for the bottle to become quite hot; then pour out the water.

Place the cork in the bottle, and insert a cigarette in the hole. Light the cigarette while pouring a glass of cold water down the outside of the bottle to cool it, and the bottle will quickly fill with smoke, thereby consuming the cigarette at great speed.

The reason for this is that the cooling of the bottle contracts the air inside, thereby setting up a strong suction, which in turn draws in the smoke.—ALFRED W. MARDT.

A "Safety First" Guard for a Leather-Cutter

THE tool shown in the illustration is the ordinary leather-cutter,



A sheet-metal guard to be placed over the knife

but it is protected over the cutting edge. Its automatic guard is actuated by the spring as shown.

The guard is shaped from sheet metal, and is slipped over the handle with an open spring which presses against it.—ERNEST SCHWARTZ.

Can You Answer these Questions on Shop Work?

THE skilled mechanic today is a specialist. He has no opportunity to build a complete machine or even a small part of one. His active work is carried along rather limited lines. But to make the best success in his work—to secure promotion to more responsible duties or to go into business for himself—it is absolutely necessary that he have a broad and comprehensive knowledge of machine work and shop practice. There is only one really feasible way for the mechanic to familiarize himself with other shop lines outside his own individual work—and that is to have specialists in all lines give him all they have learned in a form that will be readily accessible. There you have the reason for the famous standard reference work, called "Modern Shop Practice."

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A surface of cast iron is to be finished in one cut on a milling machine. The casting is 8 inches long and 5 inches wide. The milling cutter has a diameter of 3 inches and a width of 2 inches. How long will it take to do the work? Assume a feed of 2⅓ inches.

For what purpose is a magnetic chuck used?

How many processes for cutting gear teeth?

How do you determine the ratio of two gears, when the numbers of teeth are given?

The lead screw has a pitch of ¼ inch. What is the ratio of gears to be used to cut a screw with 18 threads per inch?

What determines the cutting speed in a milling machine?

Give a short description of the thermit-welding process.

What is essentially the first step in making any tool from a toolmaker's standpoint?

Why is it advisable to cut the threads of an adjustable tap somewhat smaller than the desired size for the tap to cut?

Under what circumstances would you consider it advisable to use a counterbore, rather than a drill when enlarging a hole? Why?

Why should undue accuracy never be indulged in when making drill jigs and similar tools?

What is the practical way to test the temper of molding sand?

How does the riser on a steel casting differ from one for iron?

What are some of the precautions necessary in pouring a mold in order to obtain the best results?

How are the sides of deep molds vented when a flask is used?

What point carbon steel should be used for machine tools, milling cutters, drills and taps?

Why is it necessary to reheat large pieces after they have been hardened?

What must be the outside diameter of the original wooden pattern for the rim of a pulley with six arms, the diameter of the finished pulley to be 30 inches and the width of face 9 inches?

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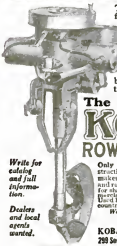

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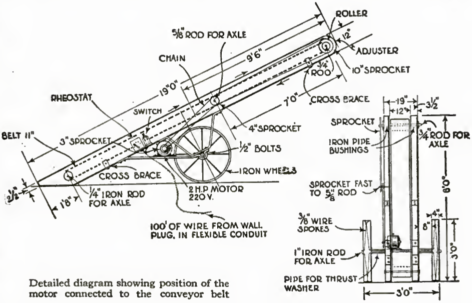
Fasten the frame together with band-iron as shown, with the belt conveyor rollers at each end. Mount the frame on two flat-rimmed iron wheels about 3 ft. in diameter. Secure these in band-rion brackets or bearings. Make the top roller adjustable at its axle, so that the belt may be tightened when required. This is accomplished with two screws, as shown in detail. The power is applied to the upper roller with a heavy chain and sprocket. If you prefer electric power, then use the following assembly of parts:

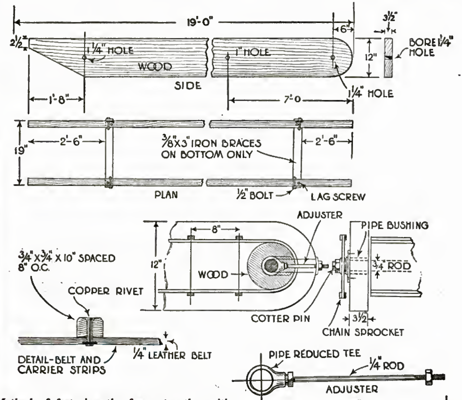
A wood frame built as described before and mounted on 3-ft. iron wheels



Detailed diagram showing position of the motor connected to the conveyor belt

This conveyor may be operated by hand-power, but a small electric motor of about 2-horsepower with a long connecting electric wire is a more efficient plan.

Make the main frame of two pieces of oak-12 in. wide and 3½ in. thick, or if one solid piece is not available use four 2-in. pieces bolted together in pairs with carriage bolts. Spruce or yellow pine will do if oak cannot be obtained.



Method of fastening the frame together with strap-iron, and fastenings of the conveyor rollers

is supplemented with a small frame made of band-iron and a piece of sheet metal $\frac{1}{8}$ in. thick on which to set the motor. From the position of the small motor is driven a counter-shaft attached to the frame, and this drives the chain to the 10-in. sprocket on the upper roller shaft. A small electric switch is fastened with screws to the side of the frame near the motor, and a length of flexible conduit is connected from the switch to the nearest current plug. This allows the conveyor to be moved about, and its radius of movement is that of the length of the electric cable. This cable should be quite long, since it is necessary to change the position of the load as well as that of the conveyor.

Motorcycle sprockets and chains are used in transmitting power from the electric motor to the roller. The bearings are made of ordinary iron rods with band-iron clamps as shown. The gear reduction from the electric motor should be estimated so that the revolutions per minute will be 25.

A good second-hand motor will do very well. These usually have a belt pulley attached. Remove this pulley and apply a heavy motorcycle sprocket. If the hole in the sprocket is too small, bore it out to fit the motor-shaft. From this sprocket run a motor-cycle chain to the counter-sprocket, which should be a double sprocket revolving on a bearing, as shown in the detail. From the counter-sprocket run another chain to the 10-in. sprocket at the top of the conveyor-frame.

To Make Adjustments

To tighten the drive chain from the motor to the counter-sprocket, shift the motor toward the rear, which is accomplished when its foundation bolts rest in slotted holes. To tighten the chain from the counter-sprocket to the 10-in. sprocket, simply screw down on the nuts of the bolts that hold the axle in place. This also makes the adjustment on the conveyor-belt when necessary. Both must harmonize. The rollers are made of two pieces of a clothes-line post sawed off to make them 11 in. long. These are bored centrally to receive a $\frac{3}{4}$-in. rod 24 in. long. This rod runs in the pieces of pipe inserted in the wood frame which act as bearings.—P. J. Avery.

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HERE is a very handy trick that mechanics will wonder why they did not think of before—a combination soft- and hard-faced hammer. When making repairs or overhauling, there are many shafts, pins, gears, bushings, etc., that one needs in order to rap in or out and yet not mar the finish. With this combination hammer it can be done. There is no need to hunt up a chunk of brass or a block of wood or to look for the copper maul.—Charles H. Willey.

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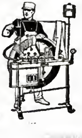

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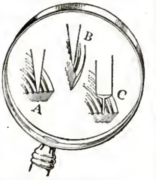

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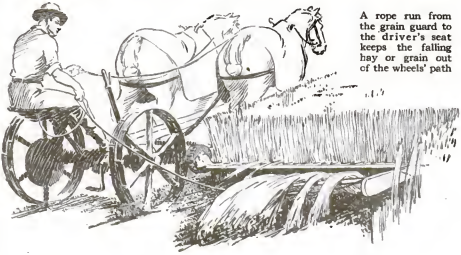
Keep the Mower's Wheels Clean with a Rope

When hay or alfalfa is extremely heavy, so that the ordinary guard or track cleaner on a mowing-machine fails to work, a rope, one end of which is attached to the end of the cutting bar at or near the end guard, and the other end attached to the seat, will do the work.

To avoid the hay being dragged along by the rope, the operator should alternately "pull up" on the rope and "ease away," causing the hay to roll out of the way. A loop within easy reaching distance makes the ropes easier to grasp.

In adjusting the rope, make it slack enough to clear the stick on the cleaner-board.—Glenn A. Granger.



A rope run from the grain guard to the driver's seat keeps the falling hay or grain out of the wheels' path

A Regular Trick Door

By means of a door that opens by sliding up and down as well as swinging inward and outward, a druggist has provided his store with an entrance that is equally suitable for all seasons of the year. In summer the store, after being once opened in the morning, has no need for doors at all; therefore in summer the perpendicular opening of the doors is used. To close up the store at the end of the day, the doors are simply pulled down and locked.

In winter the doors are permanently lowered, and then the swinging action of the two panels is used. There are, of course, two separate sets of locks by which the place may be locked against either the perpendicular opening or the swinging doors. The perpendicular movement is made easy by having the panels mounted on rollers, and by the use of weights to counter-balance the weight of the doors.

This type of door is entirely practical, and while this especial style shows it at work in a drug-store, it is adaptable to other stores as well.—John Edwin Hogg.

A door that slides upward, downward, inward, and outward is easily adaptable for all seasons of the year

Terminal for Testing Direct-Current Armatures

THE armature of a direct-current machine can be tested for common troubles by means of the arrangement shown in Fig. 1. The two opposite brushes bearing on the commutator—the other brushes being removed—are connected with a source of current through an adjustable resistance and an ammeter. The terminals of a low-reading voltmeter are attached to an exploring terminal, such as that shown in Fig. 2.

When in use the current is adjusted to cause an appreciable voltmeter deflection, when the exploring points rest on adjacent commutator bars. The points are then moved around the periphery of the commutator and bridged across the insulation between every two bars. If the deflection of the meter is of the same magnitude for every pair of bars, it indicates that there is no short circuit in the armature.

A poor connection between a bar and coil will cause a considerable meter deflection when one of the points rests on the bar in trouble and the other rests on either of the adjacent bars.—PETER J. M. CLUTE.

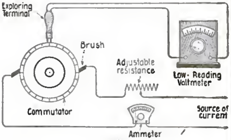


Fig.1

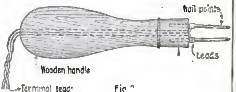


Fig. 2

Circuit showing method of making the test and (below) the device for making the connection

Worn-Out Hacksaw-Blades as Glue-Spreaders

MANY uses have been suggested for worn-out hacksaw-blades, but it is doubtful if they can be put to better employment than as glue-spreaders in the wood-worker's shop.

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A Portable Typewriter Stool for the Yard or Porch

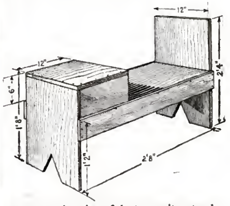
THE typewriter stool shown herewith was planned so that it could be carried out doors and used in the shade of a tree.

The construction is of the simplest kind, nothing but straight sawing and nailing being required. The entire stool was made in less than half an hour, and the size and shape of it was, to a large extent determined by the material already on hand. A piece of redwood board 8½ ft. long, 12 in. wide and 1 in. thick, and a similar piece 5½ ft. long 4 in. wide and 1 in. thick was used in its construction.

The typewriter stand as it is used outdoors under a shade tree, weather permitting

The space under the raised portion, on which the typewriter is placed forms a convenient place for loose sheets. It also provides a convenient hand-hold for carrying the stool from place to place.

Since it was made it has been put to some use by every member of the family. It has been utilized for reading, writing, peeling potatoes, and as a stand in such work as hanging out clothes and picking fruit.



A perspective view of the typewriter stand, with dimensions for its construction

A clean piece of lumber free from knots should be selected, and the plans drawn upon it with a pencil. The pieces necessary to make the stool are the front upright, the back upright, the seat, the sides of the seat, and the sides of the stool. If properly made this stool will last indefinitely.—EDWARD H. CRUSSELL.

Placing Old Tanks Overhead for Oil Storage

A SIMPLE plan of storing a number of different grades of lubricating oils is shown below. Four discarded hot-water boilers were mounted on a hanging platform, and piped to spigots brought in convenient reach for filling cans. A shelf beneath the spigots serves to hold the oil-cans. The holes in the top of the boilers where the pipes originally entered were left open as vents, and additional holes were drilled near the tops to receive short pieces of pipe with elbows for filling purposes.

Any number of these tanks may be installed overhead, making a very compact way of delivering oils

This oil magazine can be made at small expense, and is sure to prove satisfactory for the storing and distributing of oils, especially in a large garage.—ERNEST SCHWARTZ.

What to Do with Hard Spots in Welds

OXY-ACETYLENE welds often have glass-hard spots where it is impossible to grind them out, yet they must come out before machining or filing can be done.

They can often be "popped" out by the use of a sharp chisel driven in the work at the side of the spot and getting far enough under to wedge the spot off after which the work can proceed.—DONALD A. HAMPSON.

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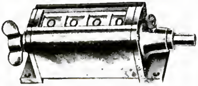

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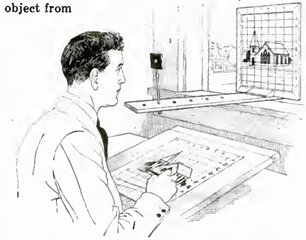
An Aid to Beginners in Perspective Drawing

AN artist never sees the object he is attempting to draw or the scene he is viewing at exactly the same viewpoint. He looks at an object, lowers his eyes to see how he is drawing what he has seen, then when he raises his head again it will be two, three, or more inches out of the position it was at first and his eyes view the object from another angle. Distortion of vision follows, and distortion of the drawing is the natural result.

Everyone who has attempted to draw at all is familiar with the old scheme of enlarging with squares—lining up the smaller drawing into squares ½ in. or more in size, lining another sheet of paper into squares 1 in. or more in size, and then drawing what appears on the small picture into the larger squares. An aid to sketching that is an adaptation of that ancient scheme, and in which the point of view remains fixed, can be made by anybody.



With an apparatus of this sort it will be easy for the artist to obtain a proper perspective

Have a frame made, or an old school-slate frame will do. Fit this frame rigidly to a bar. In this bar make holes for a small rod, which may be moved close or at a distance from the frame to focus the picture similar to moving the bellows of a camera. On one end of the rod is a piece of metal or cardboard, with a hole in the center of it for the eye aperture. The rod may be moved up and down so as to get the view one wants.

To the frame are attached fine wires or threads, forming squares 1 in. or more in size. These squares are lettered and numbered. Set the affair on a window-sill, fasten it to a tripod, or otherwise set it in place. Apply the eye to the eye-piece, focus the aid to suit requirements, or so that you can see the picture as you want it through the squares. Have beside you a previously prepared sketching paper upon which are drawn lightly, in easily erasable lines, squares larger or smaller, but corresponding in numbers with those on the frame. Then simply draw what you see.

For instance, if the point of the spire is nearly to horizontal on the vertical line, place it so on the paper. Every time you look at the object or landscape, the eye-piece takes the eye back to the original position which will obtain the proper perspective.

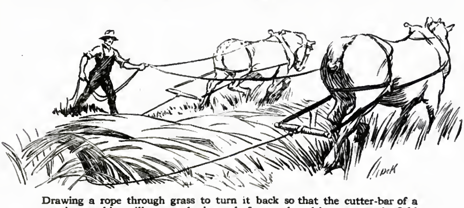
F. W. FITZPATRICK.

When Mowing in the Wind

MANY a farmer has had the disagreeble experience of mowing in a wind and seeing with disgust the hay blown under the cutter-bar when he goes with the wind. Many times he is forced to stop work until the wind lets up in order not to waste his hay; and in the haying season he cannot afford to let the work slacken.

A simple and effective way of preventing this waste is to drag across the field against the wind a long piece of heavy wire—available on almost every farm—from 100 to 500 feet in length.

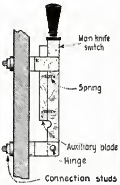
This wire is drawn across the field by two horses, one at each end. The wire bends the grass toward the coming mower, so that it falls back over the cutter-bar.—WILLIAM R. GAGE.



Drawing a rope through grass to turn it back so that the cutter-bar of a mowing-machine will pass under instead of over when driven across the field

A Quick-Break Knife Switch of the Hinged Type

WHEN a knife switch of the hinged type is opened under load, there is always a tendency for an arc to form between the blades of the switch and the contact clips. If the switch is opened slowly, the arc may eat away the blades and the clips at the points of contact, thus causing a poor connection.

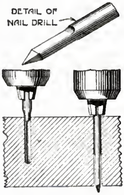


A quick-action knife switch that prevents arcs forming

Using a quick-break knife switch as herewith illustrated, an arc is not readily formed, because when the main blade is opened slowly the auxiliary blade is held by the clips until the main blade has been almost fully opened. Then the spring between the two blades will pull the auxiliary blade out so rapidly that an arc will not generally form.—PETER J. M. CLUTE.

Ordinary Finishing Nails Used instead of Drills

IT frequently happens to a carpenter or wood-worker that the bits of his automatic drill do not reach the desired depth. It is quite essential that a hole be bored deeper sometimes, for instance, where a narrow but high-backed strip of wood is to be fastened with comparatively heavy nails on short miter returns of heavy moldings and other end grain work.



Here the common finishing nail is used as a boring tool

Carpenters, as a rule, do not carry the old-fashioned gimlets, and if they do the proper size is often not at hand; but many do carry a three-jaw brace chuck, and in that case the difficulty is readily solved. Take a finishing nail of the proper size, cut off the head, flatten about 1 in. of the lower end with a file, and use it as you would a drill bit in the chuck. The flattened portion provides a small amount of clearance sufficient in most soft woods.

In hard woods the nail will have to be withdrawn after every 1 in. in depth is made to make it drill a smooth hole, but this should be done with care, as the nail is easily bent.
—HENRY SIMON.

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When such men as these, and a host of others too numerous to mention, have felt so strongly the debt of gratitude they owe this man that they have not hestitated to acknowledge it in writing, surely you also can be helped to develop your latent powers, to fill a larger place in the world, to make a *new success* of your life.

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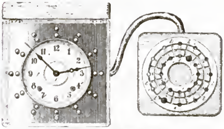
An Elaborate Electrical Plug-in Clock

ANYONE who has ever attempted to make an electric alarm-clock out of an ordinary clock has been confronted with the problem of how to get hands, to make the contact, that would be heavy enough to be reliable without being too heavy for the power of the clock. The writer found that by any ordinary rubbing contact either did not make a contact every time, or that the clock stopped whenever a contact was made by the hands. He solved this problem in the following manner:

As shown in the accompanying illustration, the clock was placed on its back and mounted in a neat polished mahogany box. Then opposite each numeral on the face of the clock was mounted a pair of steel mercury cups, each holding a drop of mercury projecting from its top. Then on each hand of the clock was soldered a rather heavy copper wire tipped with a smaller piece of platinum wire, which was bent sharply downward at its point, and so arranged that the passage of the hand across the dial carried the platinum tip through the drop of mercury.



The mercury connectors are easily connected and the clock works are not complicated

With the use of two mercury cups, it was possible to make a contact within three minutes of any desired time. Then the apparatus was wired to a plug-board constructed of brass plates with a mahogany base. A number of split plugs were used in the holes.

The apparatus was then wired as follows: Each hour cup was connected to a corresponding hour block on the plug-board, and each five-minute cup was wired to a five-minute block on the plug-board. The two complete rings on the plug-board are connected, one to the battery and one to the bell, another connection being made from the bell back through a switch to the battery, thus completing the circuit.

Consideration of this arrangement will show that the electric current is arranged to proceed from the battery to one of the plug rings, say the hour ring, thence through any plug inserted in the hour section to the corresponding hour block; thence by one of the conductors in the cable shown to the corresponding hour mercury cup; thence, when the right time comes, up to the clock hand (the hour hand, in this case); back out to the tip of the minute hand to the mercury cup it is in contact with (and which is plugged on the plug-board); thence through another of the cable conductors to one of the minute blocks; across the plug to the minute ring; thence to the bell and back through the switch to the battery, thus completing the circuit.

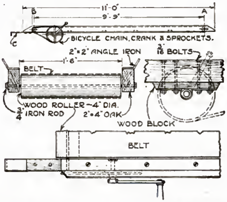


Diagram of hand-power conveyor for wagon which eliminates much unnecessary labor

The arrangement shown has many advantages over the ordinary alarm-clock. The clock may be set by many plugs to ring any number of times during the day or night—for instance, every hour during the night for giving medicine—or arranged to ring every fifteen minutes in the early morning or according to any combination.

The construction of the apparatus is not at all difficult to make, and the uses of the clock are many. It is evident that a face-winding clock having a wheel escapement must be used, since the clock cannot be moved from its horizontal position after the mercury is put into the cups. Steel or other metal must be used for the cups, because mercury will disintegrate brass, copper, or zinc.

As many plug blocks as are desired may be provided and wired in multiple, so that as many bells may be controlled from one clock as there are blocks. Thus in a boarding-house each boarder may have his own block, and set it himself entirely independent of the others, as often as he pleases and in any combination he likes.—CHARLES HORTON.

Amalgamating Zinc Plates for Battery Cells

CLEAN the zinc carefully with diluted sulphuric acid by dipping it repeatedly in a jar containing the solution, using a piece of cloth tied to the end of a stick as a mop, if necessary. Then pour a few drops of clean mercury upon the zinc, while holding it over a glass tray, and spread the mercury as uniformly as possible over the zinc by means of a cloth and stick, repeating the process until the zinc is clear.

Keep the mercury that runs off the zinc in the glass tray, and use it for amalgamating other zincs.

PETER CLUTE.

A Simple Safety Clip for Your Spectacle-Case

THE writer lost so many spectacle-cases that he invented a way to prevent it. He fastened an ordinary pencil clip in the cover of his case and attached it to his pocket. When his glasses were in his pocket, at least, they were safe.

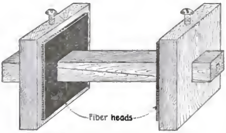
Two small slits made with a penknife are sufficient to allow the clip to go through the cover, and of course after pushing it through, you bend it back on the inside to hold it securely in place.

Try the scheme. It costs practically nothing, and will save you in the end.—J. H. MOORE.

Design of a Form for Winding Electrical Coils

IN winding coils, it is necessary to have some sort of form if an even surface to the finished coil is desired. The form shown in the illustration may be made of any hard wood, one for each sized coil, and is used in the lathe centers when winding on the wire. The bars may be of any length and the heads any size.

Before winding, rub the wood thoroughly with warm paraffin, and space the distance between the heads for the



An adjustable form for use in lathe centers to wind electrical coils evenly

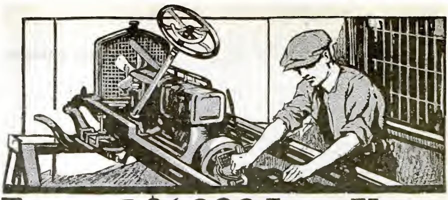
proper length of the coil. The set screws in the heads hold the position.

First lace the form in a lathe, wind on the necessary insulation, give it a coat of shellac, and then start to wind the wire, taking care that the coils go on evenly. Continue until filled, or until the proper amount of wire is run on.

To remove the coil, place one end of the coil in a vise and tap it gently with a hammer, and the core will slide out, leaving a nice square hole in which the iron strips can be tightly packed, if a transformer is being made.

Round or other shaped holes can be made by using the proper shaped bars through the heads. It is necessary to make the bars wedge-shaped, even if their outer surfaces are round, square, or rectangular.

Before the coil is removed from the form, the whole should be soaked in hot paraffin and then set aside to cool. When it is removed you will have a solid coil well insulated and quite hard.—W. E. DAY.



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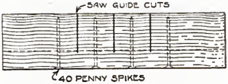
At any later date the watch may be corrected by observing the same star in the same manner. For example, ten days later the star will be on the range line 39 minutes and 19.2 seconds earlier than before.—E. EARLE GLASS.

Preventing a Miter-Box from Warping

The different sections formed by the cuts in a wooden miter-box have a tendency to warp, which makes them bind in one cut and spread in the other. They are also liable to break off.

This trouble can be effectively remedied, and the efficiency and



A phantom view of the spikes bracing the sides of the miter-box

strength of the miter-box doubled, by the simple expedient of boring a hole through each section from the bottom up, and driving a long spike into it. For the ordinary miter-box, a forty or fifty-penny spike is the best size, and the holes should be bored so as to grip the spike tightly.

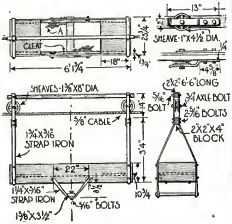
The above strengthening operation is best done when the miter-box is being manufactured, before the cuts are made in it. It is also desirable to make the miter-box so as to leave at least an inch and a half at the bottom uncut, thus forming a strong footing for the spikes.

For strengthening the miter-box this suggestion cannot be improved upon, as anyone working with a warped box is greatly handicapped in obtaining clean and accurate cuts.—HENRY SIMON.

Here's a Simple Aerial Cable Car

THERE are many types of small suspension cars, each adapted to different uses and localities. In mining regions, such a means of conveyance is very common and, where the country is precipitous, almost indispensable for transporting men and ore from one elevation to another.

The cable car shown in the accompanying drawing is, perhaps, as simple as any, both in construction and operation, and is designed to accommodate one or two persons. The sketch shows such a car as used in a canyon of the Sierra Madre Range in California. This car is used to convey passengers from a roadway, across a stream of water, from one rocky cliff to another where a cabin is built on a spur of the range. It is made from surfaced pine boards and strap-iron, and is suspended from a 5/8-in. cable of ordinary strand. Such a cable costs from 14 to 20 cents a foot, and the 8-in. trolley sheaves, when fitted with non-lubricating bushings, cost $2 each.



A cable car of this sort may be used in transporting men or material quickly and with a reasonable degree of safety

The sides of the car are nailed to a frame of surfaced studding, and the seats at each end are secured to the top of this framework, as shown by the dotted lines. The wrought-iron straps are bolted to the boards with 5/16-in. bolts, except where the sheaves are hung, and here 3/4-in. bolts are used. A stirrup or foot-rest is attached to the center of the car, and the same bolt that secures the stirrup at one end holds a separate 1/2-in sheave (shown at *A*), set within a metal guard on either side.

These sheaves are pulleys around which ropes are passed, one from each side of the canyon, thus allowing the passenger to operate the car forward or backward by pulling the rope in the direction in which it is desired to move. Cleats are provided on the inside of the car for taking up the slack rope. Labor will be saved by suspending the cable higher at one end than the other, as gravity will then force the car part way on its journey.—HUNTINGTON BAKER.

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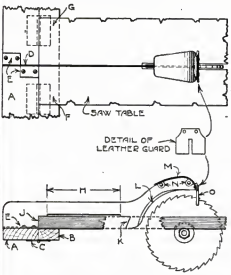
A Safety Appliance for a Circular Saw-Table

MANY of the accidents in wood-working shops result from the catching of a piece of wood upon the back of a circular saw, and striking the operator with enough force to injure him, sometimes with fatal results. This may be due to the turning of a crooked piece of wood after it has passed the saw, to a loose knot, to the pinching together of a board on account of the tendency of wood to adjust itself to the different tension of its fibers after a cut has been made, whether parallel with or across the grain, or to the piling of pieces behind the saw.

When the operator draws a piece of board back toward him to make another cut, the board may come in contact with the back of the saw and be thrown with great velocity against him if he happens to be standing in front of the saw instead of to one side.



"Don't monkey with the buzz-saw." Here's a practical way to observe that advice and keep all the fingers on your hands

Various devices for preventing this danger are made by manufacturers of wood-working machinery, and usually the best modern machines are equipped with something of this sort, though often their cost is an obstacle to their adoption.

The device described here may be made at slight expense, and fitted to any saw-table. It will prevent wood from catching upon the back of the saw, and will also keep sawdust and splinters from flying in the face or against the hands of the workman.

One of the chief obstacles to the introduction of safety appliances is the unwillingness of the men to use them; but few workmen will object to this device after using it for a few hours, since it reduces the possibility of accident to a minimum and is not in the way. The device consists of a back guide, a piece of iron as nearly as possible the same thickness but no thicker than the cut made by the circular saw that is to be used, so that the wood will not bind against its sides. It

should be cut in the shape indicated at *A*, and its dimensions must depend upon the size and thickness of the table-top and the size of the circular saw. The pieces of wood *A* and *B* should be of well seasoned hard wood, hinged at *C*.

The iron is fastened to *A* at *D* by means of ears, turned as at *E*, through which the iron may be screwed to the piece *A* directly in line with the circular saw. The device is held rigidly in place by hand-screws, or by screws at *F* and *G*.

The firmness and lateral rigidity of the back guide depend upon the accuracy with which it is fitted to the table, as the distance, *H*, in the sketch is equal to the distance between the back edge of the table at *J* and the acute angle at the back of the throat at *K*, which is the means of holding the front end of the back guide in place.

To Guard Against Splinters

The front edge should be ground to a knife edge to permit it to enter the saw cut easily. The hood *M* consists of a piece of thin sheet-iron—say of about 26-gage—fastened to the back guide by screws or rivets, through ears soldered to the under side of the hood at *N*. For additional protection, holes may be punched in the hood, and a piece of leather, *O*, may be fastened to it. This leather will keep all splinters and sawdust back of the saw, whether the saw projects much or little above the table.

The advantages of this device over some that are in use is that it can be easily removed and replaced, according to the needs of the work, by removing the fastenings at *F* and *G*, and there is nothing above or beside the saw to prevent the workman from reaching for a piece that has been pushed through. The size of the hood can be varied to suit either a finely fitting saw or a coarse rip-saw to prevent the sawdust and splinters from flying toward the front of the table.—CHARLES A. KING.

How to Detect Caramel in Vanilla

THE coloring matter in vanilla extract is due solely to substances naturally present in the vanilla bean and extracted therefrom by alcohol. Artificial extracts made by dissolving vanilla in alcohol contain no color in themselves, and caramel is commonly employed to supply this deficiency. It may readily be detected, without requiring the loss of the sample, by the use of the following procedure: Shake the bottle containing the vanilla, and observe the resulting foam after a moment's standing. The foam of the pure extract is colorless; that of the artificial with the caramel present will persist in giving a coloration to the bubbles at their points of contact.—HERMAN NEUHAUS.

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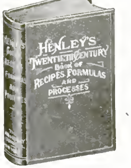

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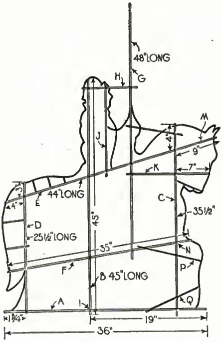
A Lesson in Kiteology

Being a version of the admonition, Go fly your kite

By C. M. Miller

ALMOST any shape kite can be worked out if we have patience and perseverance enough to plan, try out, and change until obstacles are overcome. The kite illustrated was prepared from a detail drawing made by a Chinese boy at the suggestion of the writer. The colored strappings, the silver mountings made of silver



The back of the kite as it will appear when the paper is pasted over the framework

paper, the helmet shield and spear were complete in the original drawing.

It took nearly three days to make the kite. First a general framework of spruce sticks was planned and made up. The planning was principally in reference to lightness and stiffness and in consideration of the fact that the frame must bear the strain of the pressure of the wind while keeping every portion flat. Many tryouts were made with the sticks. First they were laid one way, then another, on the sketch, until the method illustrated was decided upon.

The drawing above gives the details for the actual construction. A 3-ft. stick $\frac{1}{4}$ in. square in cross-section is used as the base line. At a point 19 in. from the right end, the vertical stick *B* is attached. This stick is $\frac{1}{4}$-in. square by 45 in. long. It comes just in front of the indentations at the back of the rider. At a point 4 in. back from the right end of the base stick, another vertical stick, *C*, $35\frac{1}{2}$ in. long, is attached. This extends to just above the bow of the horse's neck. The next stick, *D*, attached $1\frac{3}{4}$ in. from the left end of base *A*, is $25\frac{1}{2}$ in. long. The upper end of stick *D* extends just above the upper curve of the tail.

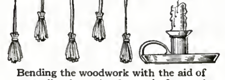
The slant stick *E* is 44 in. long. It starts half way down on the forward ear and is lashed to the vertical stick *C*, 4 in. down from the top, and again 3 in. down from the top of *D*. It is also lashed to *B*. It touches the indentation between the horse's neck and the spear, touches the horse's back just behind the saddle, and extends to just beyond the outside edge of the horse's tail.

Where the sticks cross each other, they should be let in a little, but not half way, as that would weaken them too much. Winding with strips of paper that are wet with paste makes very secure fastenings. A tough paper should be used for this purpose. The other slant stick *F* starts on the slant line of the raised foreleg, is lashed to *C* $15\frac{1}{2}$ in. above the base, and again to *D* 11 in. from the base, and is also lashed to *B*. It is 35 in. long.

Spear Sticks and Braces

The spear stick *G* is 4 ft. long; it is $\frac{1}{4}$ in. by $\frac{3}{8}$ in. at the bottom and $\frac{1}{4}$ in. square at the top. It starts on *F* 7 in. to the right of *B* and is parallel to it. It is lashed to *E*. A short stick *H* runs from *B* to *G* and down 1 in. from the top of *B*. It is needed to give poise to the head. Another vertical stick *J* is about 3 in. forward of *B*, and runs from *E* to *H*. It is only $\frac{1}{8}$ in. by $\frac{1}{4}$ in. in cross section, and prevents the body from twisting around, which it is likely to do when the paper is pasted on tight. Many smaller braces are needed; one of them, *K*, runs from *B* to the front of the nose. It will be seen that the stick extends 7 in. beyond *C*.

The framework should be laid down



Bending the woodwork with the aid of a candle; how the frame is fastened together; and decorations for the tail

frequently on the sketch to insure accuracy in the details. Sometimes it is necessary to back up a little. If we would learn to be good workmen, we should not allow ourselves to modify a sketch to suit a blunder in our work.

That cannot be done in the machine shop and it is best not to do it in kite-making.

The outline is of split bamboo. The strips are fully 1/16 in. thick and about 3/16 in. wide. The width of the strip will be the thickness of the edge of the kite. We will start at the point where the sticks *B* and *E* intersect and work around the horse's neck. The bamboo does not require much heating for this curve, as it is long and not wavy; but a little heating just beyond the top of the vertical stick *C* will help. It is well to cut into the frame a little where the bamboo is attached, as shown by *E*. The bamboo is pushed into the notch and is lashed fast with paper. Linen thread can be used for lashing, but the paper is better. When shaping the outline with the bamboo, the form should be laid down on the sketch many times to get the right curves. If a bend is too great the bamboo may be reheated and bent properly. Care must be taken in this heating process; for the bamboo may be burned so as to injure its strength.

The ears and forelock are not included in the first piéce of bamboo, but the end is at *M*. Starting at *M*, the next piece reaches to *N*, and is lashed to *F*. The bending of the front of the horse's head and neck is shown at *O*. It is inverted in the illustration. A candle gives plenty of heat for bending. The bamboo is brought close to the flame and when soft from the heat is bent with the fingers or pliers.

A small brace of bamboo 1/16 in. square runs from *C* to the outer tip of the nose to support the outline of nose and mouth.

The next line is the raised foreleg, and here the line is extended from the hoof to the base-line stick. Braces *P* and *Q* support this projection. In a similar manner the back, tail, and hind leg can be worked out, beginning just back of the saddle on the top of stick *E*. There are three short braces from *E* to the outline of the rump and tail, and two more from *D* to the outline of tail at the rear.

Chinese Rice Paper for Cover

The covering is stretched fairly tight and is pasted securely over the bamboo rim. Chinese rice paper is about the best for such purpose. When a large flat surface is used on a kite, a network of string is sometimes run across the back to give support to the paper, but it is not necessary in this kite.

The rest of the body of the horse, except ears and forelock, is sketched in and painted, and colored papers are pasted on for strappings, etc. A piece of cover-paper, such as is used for cardboard work in schools, is used to build out the shape of the spear, and silver paper is put on over this.

The outline for the Knight must be wrought with much care. A little extra color on the sleeves of the Knight and the trappings about the horse's neck add to the general appearance.

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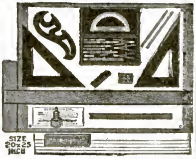

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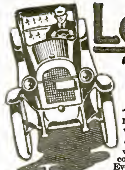

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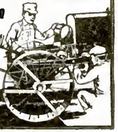

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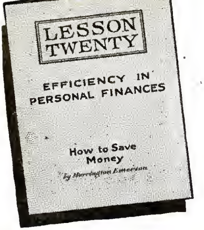

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The strappings in this kite were mostly in red, lined with black on the edges.

We need a tail for the kite, as all irregular forms must have some ballast for poise. In this case, a series of tails such as is illustrated in *R* is in keeping with the rest of the design. The straight line at the top represents the base line of the kite, and from it are suspended five strips of some semi-stiff material, as cambric or ribbon. On each strip is fastened a bunch of cut papers bound together as a tassel.

Now comes the bridle. It should be attached at a sufficient number of places to support all portions of the kite. On this one there are five strings to the bridle. One string is tied to the vertical stick *J*, where it intersects *H*. Of course, the string is carried through the rice-paper covering to the front side of the kite.

The frame, of course, is always on the back of the kite. Another string is tied to stick *E*, at the point *S*. A third string is tied at the intersection of *K* and *C*. In the kite shown these three strings are each 31 in. long. Two other strings are tied respectively to the base stick 6 in. from each end. These two lower strings are 43 in. long. It may be that the strings will have to be adjusted to other lengths. If a kite shies around to one side, it means the string is too short on one side, and it must be varied to suit the individual kite.

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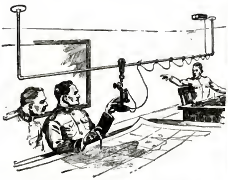
The trolley consists of a grooved wheel, having its bearings in a Y-shaped frame, from which hangs a large ring. The wheel runs upon a piece of ⅝-in. brass pipe jointed by elbows to hangers of pipe. The vertical hangers are screwed into flanged couplings, the bolt-holes of which are used to screw the framework to the ceiling.

The trolley and a number of curtain rings are run on before screwing



"Over the top" goes the telephone when the officer commands

the horizontal pipe into the elbow at one end. The telephone cord, which is of the extension type, is stopped at intervals to the rings by pieces of twine. Secured to the telephone is a hook which in no way interferes with its use, but which serves to hang the instrument to the trolley ring.

A slight push is sufficient to send the telephone from one end of the track to the other.

The scheme possesses the additional advantage of keeping the telephone out of the way when it is not in use.—C. L. LOTHROP, JR.

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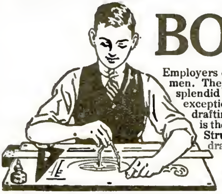

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PROSTATOLOGY is our free booklet on prostate gland disorders, see our ad under "For Men and Women." The Electrothermal Company, 1006 Coit Building, Steubenville, Ohio.

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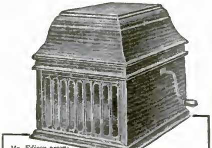

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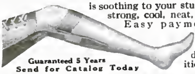

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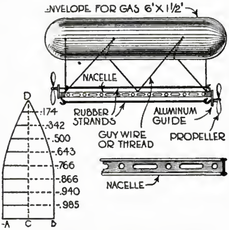
How to Construct a Model Dirigible

THE model herein described is a dirigible of the cylindrical type, having semi-spherical ends. The material used to construct the envelope is varnished silk. Its length is 6 ft. and its diameter 1½ ft. The silk should be coated with a thin varnish on the interior and exterior surfaces to increase its gas-holding property.

The constructional details of the cylindrical part of the envelope should present no special difficulty. It is best to build the cylindrical portion of this model upon light cardboard. Of course, it is essential at all times to make allowances for overlapping when cutting up the silk, both on the cylinder and the strips making up the ends. The semi-spherical ends may be readily constructed by those familiar with the development of curved

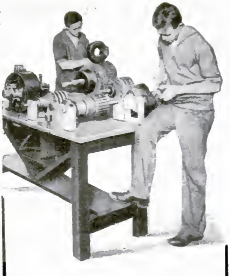


A practical model dirigible for experimental and mechanical purposes

surfaces. For amateurs unfamiliar with pattern-drafting, the following solution is offered.

The radius of the envelope being 9 in. and the plan being to employ six strips to an end, we get the maximum circumference equal to approximately 56.7 inches. Dividing the circumference into six parts, we get the base, AB, of each strip. These measurements are laid out to scale on pasteboard. Dividing the circumference by two, we are enabled to get the height, CD, of each strip. The height is divided into nine equal parts, as shown in the figure, and lines drawn parallel to the base. The actual length of the lines may be readily ascertained by multiplying the decimals in the figure by the length of the base. Twelve similar strips, with allowances made for joining, are cut from the silk, using the pasteboard strip as a pattern. The envelope being completed and permitted to dry thoroughly, it is inflated with an air-pump to ascertain whether any leaks exist.

Assuming that it is intended to inflate the model with hydrogen, which has a lifting capacity about twice as great as coal-gas, it is advisable to procure a tank of the gas under



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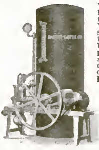

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pressure. The metallic tank is returnable, and the cost of the gas very small. If coal-gas is used, it may be necessary to obtain a small force-pump to get sufficient pressure. A small valve should be inserted at one extremity of the envelope for purposes of inflation.

In a dirigible of this size a high rate of speed is impossible, and for ordinary purposes undesirable.

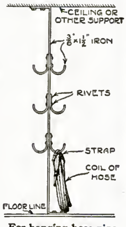
As shown in the accompanying illustration, the motor consists of two twisted rubber skeins fastened to a spruce nacelle. The nacelle, which should combine lightness with strength, is made from spruce, although other woods may be substituted. The nacelle is slotted throughout its entire length, as shown, to reduce its weight without unduly decreasing its strength. The thin guy-wires or threads should be strung as shown to afford the most efficient means of propulsion.

The propellers may be fashioned from light wood or metal. They must be arranged one in front and one behind, both being securely fastened to the nacelle by a pair of aluminum guides. Since the actual speed of the dirigible has nothing to do with the model sustaining itself in air, the propellers should be large, though light, and should revolve slowly. It is suggested that they be constructed of thin steel wire and varnished silk to secure maximum lightness. They must be of opposite pitch, and of the same weight and size. The bead bearings should be frequently oiled to reduce friction.

As is the case when air resistance must be taken into account, all of the parts must be neatly and smoothly finished to give the most satisfactory results.—HERMAN NEUHAUS.

One Way of Taming That Unwieldy Hose-Pipe

THE storing of hose in shops to be used in emergency, presents a problem to the tool-room man, owing to its shape and bulk. In order to provide a suitable storage place a rack, made as shown in the illustration is useful. The rack does not occupy much space and it obviates the old method of throwing the hose into a corner.



For hanging hose-pipe overhead, this rack saves much floor space

Each hose is provided with a strap. The hose is coiled before it is taken to the store-room, and strapped, this method making it an easy matter for the tool-room keeper to handle it.—J. R. MINTER.

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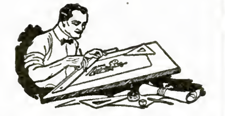

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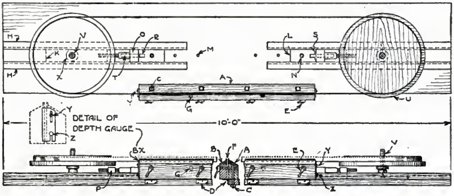
A Band-Saw Filing-Bench for Wood-Workers

Made from material found about the shop, it is easily constructed and inexpensive to build

THE band-saw filing device described here may be built from material usually found in most wood-working establishments. Its superiority over others of similar types lies in the length of the vise jaws, which permit the saw to be filed with fewer stops for changes than would be possible with a shorter vise, and the ease with which a suitable tension may be maintained upon a saw that is being filed or that is moved to bring another part of the blade into the vise.

A stout bench, not more than 3 ft. high, with a top at least $1\frac{3}{4}$-in. thick, should be built; if the top is 2 ft. wide and 10 ft. long it will be ample for the filing of any band-saws commonly used. The jaws of the vise should be 4 ft. long, or more if there is no likelihood of a saw being so short that a longer jaw would be a disadvantage.



A bench of this sort will be found invaluable in the wood-working shop

Extraordinary Firmness of the Vise

The jaws should be made of hard wood—seasoned maple preferably. The back jaw, *A*, should be $2\frac{1}{2}$ by $4\frac{3}{4}$ in. and the front jaw *B*, $1\frac{1}{2}$ by $4\frac{3}{4}$-in.

The face of the back jaw should be planed perfectly straight, while the front jaw should be slightly convex, so that when the two jaws are placed together the middles will touch when the ends are open $\frac{1}{8}$ in. or less. If the variation is made upon a true curve it will insure a perfect grip of the vise upon the saw. The tops of both jaws should be beveled about 30°, as indicated.

It may seem that the size of the jaws is exaggerated, but one who has been accustomed to a vise of half the length, which yields or vibrates from the pressure of the file, will be pleased with the firmness of this vise. The back or rigid jaw should be bolted to the bench-top by $\frac{3}{8}$ in. bolts, as shown at *C* of section *A*. The front or swinging jaw should be hung with hinges at *D*, so that the lower edge will be open about 3/16 in. when the upper edge is in perfect contact. This will allow for the spring of the wood in setting the jaws together with a saw between them.

The $\frac{3}{8}$-in. setting-up bolts, *E*, should now be put in and their heads sunk flush with the back side of the rigid jaw. The hole in this jaw, through which the bolt passes, should fit the bolt closely, but the hole in the swinging jaw should be $\frac{1}{2}$ in., which will allow play enough to permit a saw to be put in place. The bolts should be put in, a washer and lever or thumb-nut put on, the jaws forced together, and their upper edges jointed until they coincide.

Both jaws should now be removed and rabbeted to receive a piece of iron or steel about 3/16 in. thick and $1\frac{1}{4}$-in. wide upon the inside of each jaw, as indicated at *F* of the section *A*. Each should be flush with the face of its jaw, and project about $\frac{1}{8}$-in. above the beveled top, to allow for straightening and for the wear of filing. The irons should be fastened in their places by flat-headed screws counter-sunk flush. A number of $\frac{3}{8}$-in holes may be bored at *G* to receive stiff spiral springs to force the jaws open when the lever nuts have been loosened to release the saw.

Placing the Jaws Permanently

The jaws should now be put in their places permanently. The vises should be closed, and the edges of the pieces of iron, *F*, be filed straight and made to coincide perfectly, and of practically the same bevel as the tops of the jaws, though projecting a little above them.

The runs *H*, the travelers *K*, and the head-blocks *I* should be fastened with screws to the bench-top, with their common center line 10 in. from the line of the face of the rigid jaw, which should be flush with the edge of the bench. The travelers and the head-blocks must run easily, but not loosely, and the latter may be fastened rigidly by means of holes through them

to coincide with others bored in the bench-top, as indicated at *M*, through which pins or bolts, *N*, may be dropped.

The pin-blocks *O* should be fastened with screws and glue upon the head-block, and the screw-block *P* fastened by the same method upon the travelers. The screws and screw-blocks may be made from the screw-jaw of a hand-screw if a tap and die are not available.

It may be necessary to chamfer the inside edges of the runs to permit the turning of the screw without bruising the knuckles. A 5/8-in. dowel-pin at *R* may be bored into the handle of each screw, passed through the pin-block, and held in place by a pin or split key at *S*, which will connect the head-block and follower so they can be moved simultaneously in either direction.

Regulating Tension of Band-Saw

When the head-blocks are held firmly by bolts *N*, the turning of the screws *T* will move the wheels *U* endways of the bench, and govern the tension of the band-saw being filed. The wheels are each made of two circles, one 1 3/4 in. thick and 20 in. in diameter, and the other 7/8 in. thick and 22 in. in diameter. These are placed as indicated, with the grain crossed, and fastened together with screws.

A hole 1 in. in diameter is bored in the center of each wheel to fit over the pin, *V*, which should be made of hard wood (maple or hickory), and fastened to the follower about 8 in. from the end by a 3/8-in. bolt at *W*, which extends from the bottom of the follower lengthwise of the pin, and is tightened at the top of the latter by a nut. If the washer *X* is removed, the wheel may be lowered the thickness of the washer which will permit a wider saw to be placed upon the wheels.

Depth-Gage Must Be Accurate

The depth-gage *BX*, which governs the projection of the teeth above the edge of the jaws, may be made from a piece of 1/8-in. iron in which slots are drilled and filed as indicated. By means of these the gage may move up or down, its position being controlled by a round-headed screw at *Y*. The bottom slot should move freely over the shank of a convenient-sized spike under its head, or an iron pin which has been cut to a suitable length and driven into each end of the back jaw of the vise at *Z* to keep the gage upright.

The gage may be adjusted to keep the band-saw at just the right height in the vise jaws, by the screw *Y*, and setting it up to hold the gage in place. If the pin *V* and the edges of the runs *H* are waxed occasionally the friction will be reduced to a minimum.—CHARLES A. KING.

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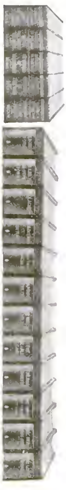

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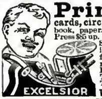

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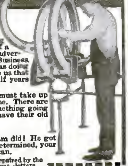
Mr. Oldham was telegraph operator for the Illinois Central Railroad for twenty years. He is fifty-eight years old. During all those twenty years, he drew the customary monthly salary of a telegraph operator—no more—no less. One day he read one of my advertisements and the possibilities of making money in the Auto Tire Repair Business. In a few weeks he had purchased and installed a Haywood outfit, and was doing business for himself. He was **His Own Boss.** A short time ago he wrote us that his income in four months was as much as it had been in Two and One-Half years as Telegraph Operator.

You men who have been left at home—who are beyond the draft age, can and must take up the burdens left behind by others. Oldham is a living example of what can be done. There are **thirty million** tires in use every day—punctures and blow outs are common. Something going wrong all the time. New tires advancing to prohibitive prices. Owners forced to have their old tires fixed.



YOU MEN

Who are seeking an opportunity to establish yourself **permanently**, do as Mr. Oldham did! He got busy and cleaned up from the start. Why don't you? If you are sincere, earnest, determined, your **entire** future is secure. If a man 58 years old can make the success Oldham has—you can.

I have a big interesting book to send you--a book about tires--it tells all about them--how they are repaired by the Haywood method--explains this business--gives inside figures and profit. Gives actual proof of success--letters of others who are now operating Haywood Shops and making big money. What these men have done, you can do. $2500 to $4000 a year is conservative.

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Sign the coupon and mail it today, or send a post card or letter

M. HAYWOOD, *President*
Haywood Tire & Equipment Co., 794 Capitol Ave., Indianapolis, Ind.

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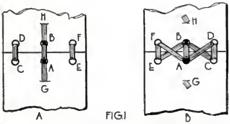
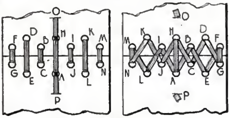
How to Lace Leather Belts Effectively

IN a laced belt, it is important that the ends of the belt be held securely in alignment, that the lacing pass quietly over the pulleys, and that the lace be not subjected to unnecessary wear. The ends of the belt should be cut squarely, of course, and the holes punched in each end should be as small as possible, and located exactly opposite each other; but much depends on the system of lacing that is adopted.

There are two important conditions that should be met by any good system of lacing driving belts. First, on the face of the belt—that is, on the side of the belt that runs next to the pulleys—the lacing should lie smoothly in the direction of the belt movement; all crossing in a diagonal direction must be done on the back of the belt. Second, there should be the same number of "tucks," or piles, of the lace on the face of the belt, between each adjacent pair of holes.



A FIG.1 B



A FIG2 B

Many methods are used for lacing belts; but these are two of the most practical ones

Occasionally mechanics adopt a "pet" system of belt lacing, but there are two well known systems that are considered very effective. The method illustrated in Fig. 1, in which (*a*) shows the face and (*b*) the back of the belt, is commonly employed for narrow belts, especially those consisting of a single thickness of hide.

A single row of holes is punched in each end of the belt, and the lace is first drawn up through *a*, Fig. 1 (*a*), and down through *b*. It is then passed twice through the holes *c* and *d*, through *a* and *b*, twice through *e* and *f*, and up through *a*.

With a flat-bladed awl or the small blade of a pocket-knife, a transverse incision is now made at *g*, and the end of the belt lace secured by being drawn through to the back of the belt, a small nick, or barb, being made in the side of the lace to prevent pulling out. The other end of the lace is brought up through *b*, and fastened at *h* in a similar manner. In this system there are two thicknesses of the

lace on the face of the belt, between each pair of holes.

The method of lacing a belt shown in Fig. 2 (*a*) and (*b*) should be used for belts wider than 3½-in., or for double belts consisting of two thicknesses of the hide cemented together. In this case, two rows of holes are punched as shown, and the lace is first passed down through the hole *a* Fig. 2 (*a*), and then through the various holes in the following order: *b, c, d, e, f, g, d, e, b, c, h, a, i, j, k, l, m, n, k, l, i, j, h, a, h.*

After being brought up through *h*, the end of the lace is fastened at *o*, as in the previous instance. The first end of the lace is drawn through to the back of the belt and fastened at *p*. In this case, there are two thicknesses of the lace on the face of the belt in each instance; but sometimes the last movements from *h* to *a* and from *a* to *h* are omitted, in which case the center holes only carry one thickness of lace on the face, which, however, is unimportant in this instance.—C. J. BRICKETT.

To Make a Saw-Horse Stand Level

ANY saw-horse or table that rests unevenly upon three legs is annoying to a degree entirely out of proportion to the ease with which the trouble may be remedied. One method is to find out which leg of the saw-horse or table is too long, and to cut it off by guess. Perhaps this may effect a cure and perhaps not; but the simple method described here will do so with certainty.

Usually the saw-horse will be found in a wabbly condition and few know just how to make it stand solidly

Turn the table or horse upside-down upon the floor, as shown in the sketch, and measure the height desired, or measure the shortest leg upon a stick held perpendicularly to the floor, as at *A*. Transfer the same distance to *B*, *C*, and *D* by holding the stick in the same position at each leg, being careful not to press down upon either leg when the mark is made. With a straight-edge mark from *A* to *B*, *B* to *C*, etc., and saw to the lines thus obtained. If the work has been done with reasonable accuracy, and the floor is straight, the saw-horse or table will stand firmly.—CHARLES A. KING.

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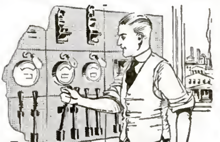

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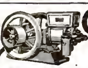

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The round graver is made from an old file which has been ground smooth and the end cut off at a point that will give a diameter of about 5/16 of an inch, this size proving to be the best for an all-around general tool. The 32-degree angle has been determined by experiment. When the handle of the tool is depressed about twenty-five degrees it will give the most efficient rake and still have a proper clearance.

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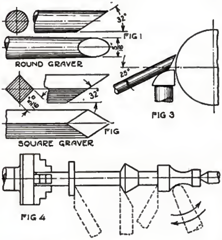

For purposes of economy old files may be used to good advantage in this way

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Always remember that a very light pressure is required to make the tool cut, and that it should never be forced.

The round graver is the best for roughing out work, since it will cut faster and is much more convenient than the square graver, which is better suited for finishing, and for facing, shouldering, and so forth.

Fig. 4 shows a few uses of the graver. Very little experience is necessary to make one proficient in the use of these tools and they can be used for practically any of the above-mentioned operations successfully by the amateur, or experienced machinist as well.—J. R. MURPHY.

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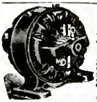

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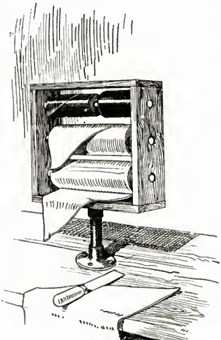

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The frame is of two-by-four lumber, with holes bored through the sides to hold the rolls. The rack revolves on a piece of ½-in. pipe, threaded on one end to fit a wide collar which is screwed to the center of the table. On the bottom of the rack is screwed a piece of two-inch flat iron, into which is bored a hole a trifle larger than the pipe support. This hole extends into the wood to a depth of 1 in. to act as a recess for the pipe support and increase its rigidity. Another collar is screwed to the iron to hold the pipe in place.

On the end uprights of the rack may be hung knives, rollers, stitchers, scissors, etc., thus keeping the table clear of working tools and allowing more table space for repairs. The entire contrivance is so simple that any vulcanizer can construct one easily. Digging into drawers and inaccessible places about the work-bench is not only time lost but very aggravating to the vulcanizer who wants to do a job in a hurry. This device will do away with old-time methods and help put the shop that employs it on an efficient basis.

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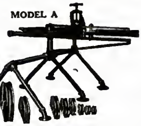

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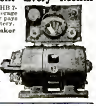

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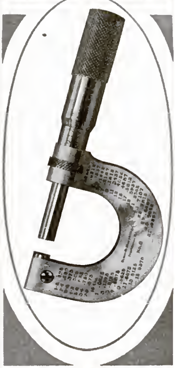

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It is only necessary to take a Brown & Sharpe Tool in your hands to appreciate its quality. The sharp, clean graduations and the fine finish speak of their quality in such a decided way that even though the accuracy and durability of-these tools were not guaranteed by the Brown & Sharpe trade mark you would instantly know that both were assured by the quality appearance of these world known tools.

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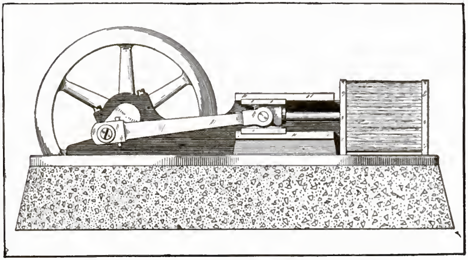
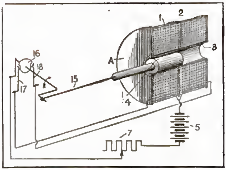
PROVIDENCE, R. I., U. S. A.

How to Make a Simple Electric Engine

THE make-and-break device for running this electric engine consists of a pair of solenoids arranged end to end with a simple armature passing to and fro from one to another and making a contact at each end of its travel. The heavy armature makes it possible to design the apparatus to make any required number of breaks per second or per minute. Such a reciprocating armature evidently acts like a piston of a steam engine. If then the other parts are added a toy can be made which will be very interesting to watch in operation.



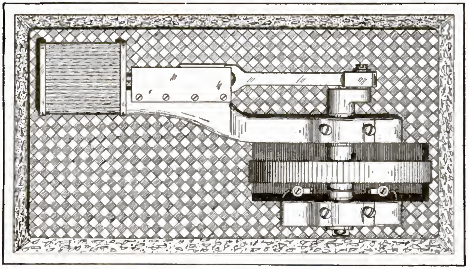
The engine looks like the ordinary stationary steam-engine, but it runs by an electric solenoid that constitutes the cylinder



A diagrammatic view of the solenoid cylinder and wiring circuit to the batteries

The diagrammatic illustration will serve to make clear the construction of the apparatus. One of the illustrations is in cross-section to show the interior construction of the reciprocating mechanism. In this view *A* represents a form on which are wound the two coils 1 and 2. The cover or brass tube 3 makes the cylinder in which the soft iron armature 4 slides. The line 15 represents the rod connected to the piston 4, and 16 represents the crank with the circuit breaker. The brush 17 connects the coil 1, and the brush 18 connects the coil 2. The power is supplied by the battery 5 and the speed of the apparatus is controlled by the resistance 7.

The illustration of the side view of the engine shows that it may be made of wood, but babbitt metal may be cast in plaster-of-Paris molds for the parts. The engine is shown in correct proportions and may be made in any size as long as the proportions are kept correct. The base is of wood which has been marked with ink to imitate concrete.—CHARLES HORTON.



A plan view of the engine, showing the wood base, which is marked to imitate tile on a concrete foundation

Broom Handles Helped Make This Tea-Wagon

YOUR old broom-handles can be used for something else besides churn-dashers. The tea-wagon shown in the illustration was made from broom-handles and cheese-boxes, the greatest expense being for the glass for the trays.

Broom-sticks form the handles and the lengthwise supports, and the tongue of a child's wagon form the front and the bottom crosswise support. Pieces of wood 1 in. by 1½ in., dovetailed together at the corners, made the tray support and slanting part of the handle. The front rung of a discarded rocker, was just the thing for the handle.

The trays are of graduated depth and size, a cheese-box top being used to make the top tray—the largest and shallowest — and a cheese-box for the bottom tray and another cheese-box sawed down to a depth of ¾ in. for the center tray. Flat pieces of wood about shingle size support the center and bottom trays. The attic yielded up the casters and wheels, and brown and tan figured cretonne was very effective under the glass.

Attractive and useful, this tea-wagon is quickly made

It was put together with finishing nails and screws, sandpapered and stained in light oak, and trimmed with yellow plaited raffia.—C. GILES.

A Makeshift Coffee-Grinder that Most People Have

IF you should need to grind some coffee and do not possess a coffee-grinder, use your meat-grinder.

Be sure the grinder is dry. Using the smallest cutter, or the one having holes about ⅛-in. in diameter, feed the coffee in slowly, and operate as usual. The offee will come out partly ground and partly cut and broken into small bits. While the meat-grinder will not grind it quite so fine as a regular coffee-grinder does, still it comes out in pieces small enough to allow proper brewing of the beverage.

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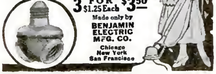

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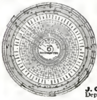

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Made of Harness Leather—Strong and Durable

Combines all the good features of the various common leather bags. Strongly built for rough usage. Bottom is three ply and steel studded. Has saw and bit holder, hand strap, and shoulder strap with pad. A mighty good, all-around tool bag. Six sizes ranging from 14 x 8 inches to 24 x 8 inches. Show this ad to your dealer and ask for the genuine KLEIN tool bag. If unable to get it write us.

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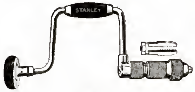

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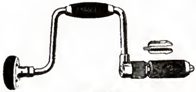

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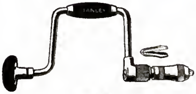

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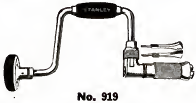

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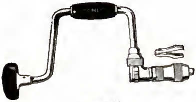

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Particular attention is called to the Concealed Ratchet Type Nos. 811, 901, 921. The Ratchet Mechanism is entirely enclosed, which not only keeps same free from dirt and moisture, but thoroughly protects the user's hands.

The illustrations above show only a few styles. Catalogue No. 34S shows our complete line. May we send you a copy?

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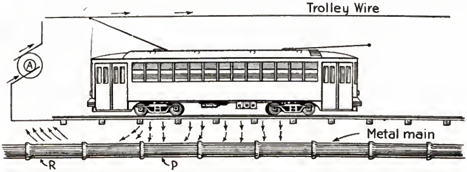
How Electrolysis Destroys Water-Mains

IN electric railways, it is customary to employ the track as a return circuit. The rails, not being grounded, allow the return current to leak into the ground, and to traverse any path of low resistance it can find, such as metal water- or gas-mains, back to the generator, which is also grounded.

This action is shown in the accompanying illustration. At *P*, where the current enters the pipe, no harm is done; but at *R*, generally near the generating station, where the current leaves the pipe, there is all the action that occurs at the positive pole of an electroplating bath. The main, being in more or less moist ground, is in contact with water containing salt in varying quantities, which causes it to act as an electrolyte. Consequently, as the current leaves the pipe, a chemical action is set up between the pipe and salt water, by which action the pipe is eaten away in places, and iron particles are carried by the electric current to some outside material, which for the time being acts as a negative plate.

Various means and precautions have been taken to avoid this electrolytic destruction of the mains. The following are three such methods: the heavy bonding of the rails to secure a path of low resistance through them; the use of a second trolley wire return; and tapping a return line on the mains to conduct back to the generator the currents they carry, without permitting it to flow through the water and cause electrolysis. The second method is the most efficient, but as it is also the most expensive, it is seldom used.



Showing the points where the current enters and leaves the main, which is the place where the metal is taken away and deposited like electroplating to another electrode or through the earth

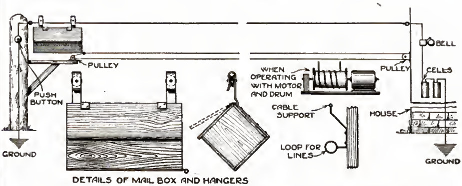
A Trolley Mail-Carrier for the Farm-House

WALKING down the lane to the mail-box may be all right in pleasant weather or slack times, but otherwise it becomes an unpleasant duty. The mail-box shown below can be built easily and inexpensively.

First, a post is erected at the road and is fitted with a wood bracket on the side facing the house. From the top of the post is stretched a stout wire cable in a straight line to a convenient point at the house. The cable is then electrically connected to a push button, as indicated, which in turn is grounded to a metal plate buried deep in the ground near the post. Similarly, the house end of the cable is connected to a bell and set of batteries.

A mail-box consisting of a simple wood box suspended from the cable by one edge is fitted with deep grooved door-hanger pulleys which constitute the carrier. One of the top sides is hinged and acts as the cover. A screw-eye is placed in the outside bottom corner, and connected by a light endless line to two pulleys, one with the end of the bracket and the other with the house.

If the house is equipped with electricity, a small motor will do the trick.—L. B. ROBBINS.



A trolley letter-carrier box to run down to the gate for the mail. It is driven by a small motor and has a bell signal attached to the bell circuit of the house

This One
8JR1-LLG-4R2W

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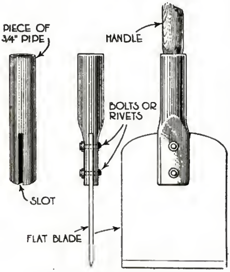
A Sod-Cutter Made from an Old Shovel

A SOD-CUTTER or edge may be made out of an old shovel and a piece of ¾-in. pipe which will equal the market article in every way, besides being sharper and more substantial.

A slot is cut in the pipe to receive the blade, and holes are drilled in the sides to receive the rivets. An old shovel will furnish both handle and



An old shovel, a piece of pipe, and your new sod-cutter is ready

blade, and when all are in their proper positions the blade-holder is flattened against the blade as shown in the sketch.—JAMES A. KANE.

One Method of Combating the Spanish "Flu"

TO avoid spreading influenza germs among factory hands who used an ordinary bubbler drinking fountain, one large concern attached an electric

Putting the Spanish influenza in a cage

light wire guard, in the manner shown in the illustration, to keep the drinker's mouth from touching the outlet.—MAURY ROBINSON.

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THE easiest and quickest way to repair leaks in radiators, pumps, water jackets, hose connections, etc., is to use Johnson's Radiator Cement. This will stop the leaks instantly without laying up the car. No mechanical experience is required—all you have to do is remove the cap and pour the liquid into the radiator.

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Merely send us the coupon. We ship an Oliver to you. Try it for five days. Then, if you agree that it is the finest typewriter at any price, merely send us $3 per month, until the $57 is paid.

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When the Oliver comes to you, you will admire its many advancements—all the refinements made possible during 24 years of typewriter-making. A finer typewriter is impossible.

The coupon below gives you the opportunity to be your own salesman and save yourself $43.

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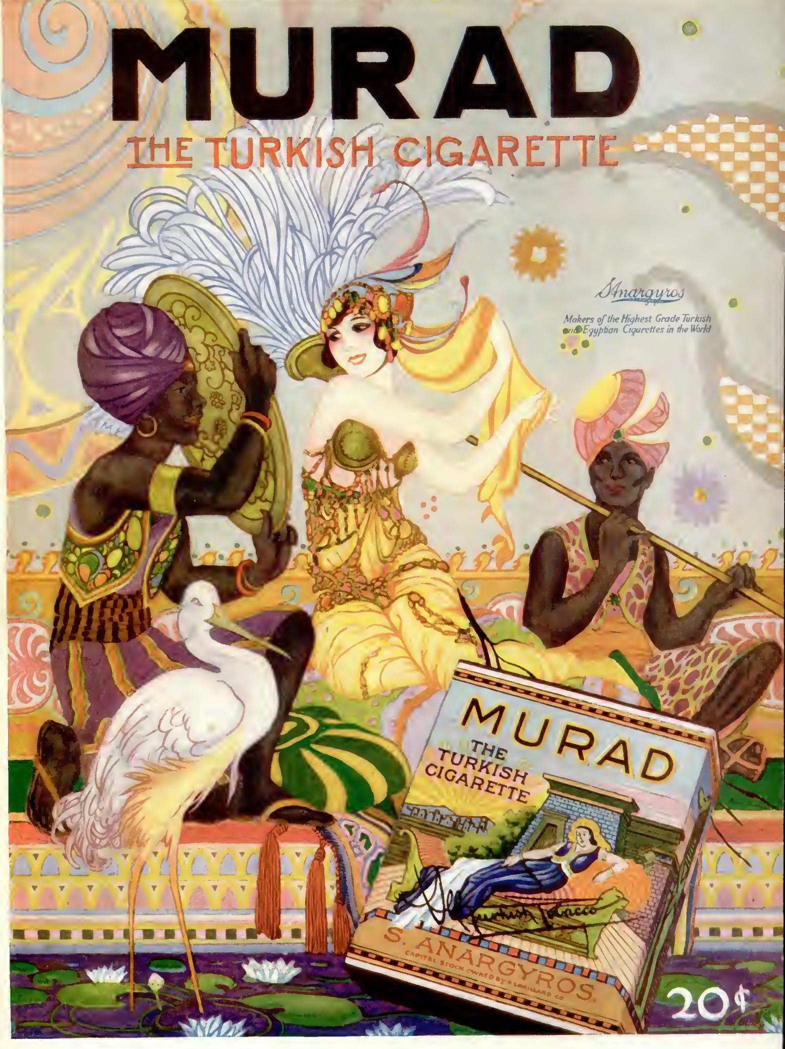
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